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NORTON SOUND - PORT CLARENCE - KOTZEBUE

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PRESENTATION

This report summarizes the 1994 season and historical information concerning management of the commercial and subsistence fisheries of the Norton Sound, Port Clarence and Kotzebue Sound districts. Data from special management and research projects are included in this report. A more complete documentation of project results will be presented in separate reports.

Data presented in this report supersedes information found in previous management reports. An attempt has been made to correct errors presented in earlier reports. Previously unreported data has been included and is indicated by appropriate footnotes. Current year catch data presented has been derived from seasonal field data.

This report is organized into the following major sections:

- (1) Salmon
- (2) Herring
- (3) King Crab
- (4) Miscellaneous species

In order to facilitate use of this report, tabular data has been separated into two categories: 1) tables presenting annual data; 2) appendix tables which present historic comparisons. The text for each major section is followed by tables, figures, and appendices.

SECTION 1: SALMON
(Includes Norton Sound, Port Clarence
and Kotzebue Districts)

SECTION 1 - SALMON

INTRODUCTION

Boundaries

The Norton Sound, Port Clarence and Kotzebue salmon management districts include all waters from Canal Point in southern Norton Sound to Point Hope and includes St. Lawrence Island. These management districts comprise over 65,000 square miles, with a coastline exceeding that of California, Oregon, and Washington combined.

Salmon Resources

Five species of Pacific salmon are indigenous to the area with chum (Oncorhynchus keta) and pink salmon (O. gorbuscha) historically being the most abundant. Chum, pink, and chinook (king) salmon (O. tshawytscha) have been found as far north as Barrow; however, these species are uncommon north of the Kotzebue Sound drainages. The northernmost large concentrations of chum salmon are found within the Kotzebue Sound drainages, while large numbers of pink, chinook and coho (O. kisutch) salmon are not found north of Norton Sound. Very small sockeye (red) salmon (O. nerka) populations exist within a few Seward Peninsula drainages.

Commercial Fishery

In 1959 and 1960, Department biologists conducted resource inventories which indicated harvestable surpluses of salmon available in several rivers systems of the Norton Sound Arctic area. The Department liberalized various regulations and encouraged processors to explore and develop new fishing grounds. As a result, commercial salmon fishing activity has grown significantly since statehood, enabling many local residents to obtain a cash income.

The majority of commercial fishermen and many buying station workers are resident Eskimos. Commercial fishermen operate set gillnets from outboard powered skiffs to capture salmon. All commercial salmon fishing is done in coastal marine waters.

Salmon effort and catch per unit effort data (CPUE) presented throughout this section have been derived as follows. Boat (or fisherman) hours have been computed after assuming that if a fishing boat delivers during a fishing period, it fished the entire period. The total number of individual boats delivering in any period is multiplied by the number of hours open to commercial fishing. Catch per fisherman (or boat) hour is obtained by dividing the total fishermen hours into the catch for the corresponding period of time. Total fishermen (or boats) is the total number of fishermen making deliveries, regardless of how many deliveries were made

or days fished during a particular period or season. There are a number of fishermen who deliver only once or twice during the entire season. Total days fished is the total number of hours open to commercial fishing during the season divided by 24 hours.

Subsistence Fishery

There are approximately 16,000 people in the area, the majority of whom are Eskimos, residing in more than 26 small villages scattered along the coast and the major river systems. Nearly all of the local people are dependent to varying degrees on the fish and game resources for their livelihood.

Subsistence fishermen operate gillnets or seines in the main rivers and, to a lesser extent, in the coastal marine waters capturing primarily salmon, whitefish, arctic char and inconnu (sheefish). Beach seines are used near the spawning grounds to catch schooling or spawning salmon and other species of fish. The major portion of fish taken during the summer months is air dried or smoked for later consumption by villagers or occasionally their dogs.

Subsistence catch information has been derived from interviews of fishermen, actual counts of fish, and subsistence catch calendars returned by fishermen. Subsistence salmon catches in the Nome Subdistrict (Subdistrict 1) have been determined from the return of catch calendars as required under a permit system.

The Department conducted annual surveys of the important subsistence salmon fisheries from the early 1960's until 1982. Subsistence harvest information prior to 1960 is incomplete or entirely lacking for many years. Beginning in 1983, budgetary restrictions have made it impossible to conduct systematic surveys in each village as was done from 1964 to 1982. For the last 5 years that complete surveys were conducted for Norton Sound (1978-1982) the average subsistence catch was 73,000 salmon including all species (Appendix Table A8). The majority of salmon taken are pinks and chums. Subsistence surveys for the Kotzebue area were less complete. An expansion of documented surveys from several years for different villages estimates total subsistence salmon harvest for the Kotzebue Sound area to approach 75,000 (Appendix Table C6). These reported harvests are primarily based on village household surveys. Since not all fishermen are contacted, these harvests should be considered minimum figures. More recent surveys have been conducted on individual areas and will be noted in the following sections (Appendix Table G2).

Management

The Division of Commercial Fisheries of the Alaska Department of Fish and Game is responsible for the management of commercial and subsistence fisheries in this vast area. The permanent full-time staff assigned to this area during 1993 consisted of an area management biologist stationed in Nome, an assistant area biologist stationed in Nome, an Area Fish Culturist, an

assistant management biologist in Kotzebue, a Research Biologist assigned to Anchorage and seasonally to Kotzebue, and a Field Office Assistant (FOA) assigned to the Nome office. In addition, summer seasonal assistance in conducting various management and research activities was provided by 17 seasonal biologists and technicians in Norton Sound and Kotzebue Sound. Additional assistance was provided by biologists from the regional staff.

The main objective of the Department's program is to manage the commercial salmon fisheries on a sustained yield basis. Various field projects are conducted to provide information on salmon abundance, migration and stock composition. Summaries of these projects are presented in Appendix G2.

Management of the salmon fishery is complicated by the difficulty in obtaining valid escapement data in this large area and by insufficient comparative catch and return information. Management problems are compounded by the need to provide not only for adequate escapements, but for the needs of several different user groups. Past Alaska Department of Fish and Game policy has been to provide for subsistence as the primary beneficial use of the fishery resource. This policy is now State law. If the subsistence harvest or demands increase, commercial fishing may be restricted. It should be pointed out that increases in commercial fishing efficiency are expected and may balance any immediate decline in subsistence utilization or increase in run size with the result that present regulations have been maintained or made even more restrictive.

The basic regulation that governs the commercial salmon harvest in all districts is the scheduled weekly fishing period. Commercial fishing regulations provide for a total of two to four days of fishing per week during the open season depending on area and season. The Department attempts to distribute fishing effort throughout the entire return to avoid harvesting only particular segments of the return. Occasionally, fishing time is increased or decreased by emergency order, depending upon fishing conditions and the strength of the returns or spawning escapements, as determined by special studies conducted by the Department. Emergency orders issued during the 1994 seasons are presented in Appendix G3.

Weekly fishery reports, which give information on fishery status and fishing schedules, are broadcast during the fishing season over radio KICY and KNOM in Nome, and KOTZ in Kotzebue. In addition, fishery news articles are published in the Nome Nugget and the Arctic Sounder.

NORTON SOUND DISTRICT

District Boundaries

The Norton Sound District includes all waters from Canal Point Light north to Cape Douglas. This district is subdivided into six subdistricts: Nome (Subdistrict 1), from Penny River to Topkok Head; Golovin Bay (Subdistrict 2), from Rocky Point to Cape Darby; Moses Point (Subdistrict 3), from Elim Point to Kwik River; Norton Bay (Subdistrict 4), from Kuiuktulik

River to Island Point; Shaktoolik (Subdistrict 5), from Cape Denbigh to Junction Creek; and Unalakleet (Subdistrict 6), from Junction Creek to Black Point (Figure 1).

Each of these subdistricts contain at least one major salmon spawning stream. All commercial fishing is conducted in marine waters and usually concentrated near stream mouths. Subdistrict boundaries were established around the major salmon producing local streams to minimize interception of stocks bound for other areas.

Historical Fishery Use

Fishing has been a part of life for Norton Sound residents for many centuries as indicated by archeological evidence dating back 2,000 years (Bockstoce, 1979). There were only a few actual pre-contact settlements like Shishmaref and Wales which still exist today. They were located where marine mammals were the primary subsistence resource. The rest of the population lived in small groups scattered along the coast and often moved on a seasonal basis prior to the introduction of western civilization (Thomas 1982). During summer months residents would disperse, usually in groups comprised of one or two families, and setup camps near the mouths of streams. Harvest levels of fish on any one stream were relatively small because of the low concentrations of people who caught only what their families and one or two dogs needed through the winter (Thomas 1982).

A large scale fur trade had been developed by the Russians in the late 1800's which continued after the American purchase (Magdanz 1981). The activities and support for hundreds of commercial whalers and trading ships caused trading to increase in the region around 1848 (Ray 1975). The increased competition for walrus, caribou, and other species from outsiders may have increased the importance of salmon to area residents (Magdanz 1981). In the late 1890's gold was discovered on the Seward Peninsula and boom-towns sprang up with thousands of new immigrants flocking to the region. Commerce developed which drew people to central locations that evolved into year-round communities. Other reasons for communities to become established stemmed from the operation of missions.

The impacts of mining was significant on fish populations. Nearly every stream on the Seward Peninsula had some sort of mining operation working on it which ranged from simple gold panning to sluice boxes to hydraulic giants to bucket line dredges. One example of extensive impact was on the Solomon River which is only 30 miles long but had 13 dredges working at one time. Another obvious impact was simply the large number of people who came to live in the region between 1900 and 1930. Communities like Nome, with a population of 30 thousand and Council with 10 thousand people at one time, did not exist before gold was discovered.

It was in the late 19th century when the size of the dog teams increased from two or three to as many as ten to twenty. At about the same time wooden boats began to replace kayaks (Thomas 1982). Consequently, the demand for dry fish to feed the dog teams increased along with the development of better means to harvest fish. Winter transportation throughout the region was

done with hired dog teams and drivers who carried mail or freight along the coast and across the state to the ice-free port at Seward. Dry fish became a major barter item in response to the great demand for dog food which consisted of primarily chum and pink salmon (Thomas 1982).

Local residents would spend most of their summers catching and drying large amounts of salmon, some of which they kept for themselves and the rest would be bartered or sold to mining camps, roadhouses, and trading posts or stores. For example, the Haycock mining camp on the Koyuk River would buy about two tons of dry fish each year. There were roadhouses at Golovin, Walla, Moses Point, Isaac's Point, Ungalik, Robertvale, foothills (south of Shaktoolik), Egavik, and many other locations. Dry fish was bought in units of bundles (50 dry fish tied together) at a typical price of 10 cents per pound from the fishermen. One elder in the area felt that more fish were retained for their own use as compared to the amount sold which may have averaged five to ten bundles per household (Thomas 1982).

After the gold rush the number of people gradually decreased over the next twenty years as the gold deposits were worked out. The number of dog teams diminished by the mid 1930's with the introduction of the mail plane. The last mail team contract ended in 1962 at Savoonga. Local stores continued to trade in dry fish at Shaktoolik, Saint Michael, Unalakleet, and Golovin. An example of quantity was the Shaktoolik store that had a cache 8x20x40 feet which would be filled to the top with dry fish. One elder said the stores would buy the fish for 6 cents a pound and sell them for 10 cents a pound or their equivalent in groceries and supplies (Thomas 1982). By the early 1960's, commercial salmon fishing developed into a source of summer cash and snowmachines were replacing the need for dog teams (Thomas 1982). Dry fish was no longer needed to feed dogs and cash was becoming more available for trading at stores.

Commercial Fishery Overview

Commercial salmon fishing in this district first began in the Unalakleet and Shaktoolik Subdistricts in 1961. Most of the early interest involved chinook and coho salmon which were flown in dressed condition to Anchorage for further processing. A single U.S. freezer ship also purchased and processed chum and pink salmon during 1961. In 1962, two floating cannery ships operated in the district and the commercial fishery was extended into the Norton Bay, Moses Point and Golovin Bay Subdistricts. The peak in salmon canning operations occurred during 1963.

Since then, markets have been sporadic and some subdistricts have often been unable to attract buyers for entire seasons. A joint venture between KEG (Koyuk-Elim-Golovin) Fisheries and NPL Alaska, Inc., operated from 1984 until mid-season in 1988. A permit issued by the Governor allowed two Japanese freezer ships to buy directly from domestic fishermen and was limited to salmon caught in the internal waters of Golovin and Norton Bays. Currently, the most consistent markets are at Unalakleet and Shaktoolik where fish are purchased, iced, and flown directly to Anchorage for processing and resale.

The commercial salmon fishing season opens by emergency order between June 8 and July 1, depending on run timing within each subdistrict. The season closes by regulation on August 31 in Subdistricts 1, 2, and 3, and on September 7 in Subdistricts 4, 5, and 6, but processors often terminate their operations prior to the regulatory closure dates. Two 48 hour fishing periods normally occur each week unless changed by emergency order with the exception of the Nome and Moses Point Subdistricts, where two 24 hour fishing periods are scheduled each week.

Commercial fishing gear is restricted to set gillnets, with a maximum aggregate length of 100 fathoms allowed for each fisherman. There are no mesh size or depth restrictions during the normally scheduled periods. The majority of the gillnets fished are approximately 5 3/4 inch stretched measure. In the Unalakleet and Shaktoolik Subdistricts, 8 1/4 inch stretched mesh gillnets are commonly used during the chinook salmon run in June through early July. During years when large pink salmon runs occur, the Department provides fishing periods when only 4 1/2 inch mesh nets or less may be set or drifted. These special small mesh periods are an attempt to target pink salmon without over harvesting the larger sized salmon species.

Most fishermen do not tend their nets continuously once they are set, leaving them unattended overnight. Fish quality suffers due to the length of time fish may be left in the nets and is especially poor when storms prevent fishermen from checking their gear for extended periods of time.

Commercial Fishery Management

The Norton Sound District is managed on the basis of comparative commercial catch data, escapements and weather conditions. A single factor or combination of factors may result in issuance of emergency orders affecting seasons, fishing periods, allowable mesh size, and areas.

Aerial surveys are used to monitor escapements in the majority of the Norton Sound streams. Weather conditions, time of day, type of aircraft, water conditions, bottom conditions, date of survey, and efficiency of the surveyor and pilot must be taken into account when making inter-annual aerial survey comparisons. Counting towers are a much more consistent and accurate method of obtaining escapement information and have been utilized on many river systems in Norton Sound. Two counting towers were operated in 1993, one on the Kwiniuk River in the Moses Point Subdistrict and on the Nome River in the Nome Subdistrict. The Kwiniuk Tower has been operated since 1965 while 1993 was the first season that Nome Tower was operated.

Commercial fishing starts for king salmon in mid June, emphasis switches to chum around June 25, then gradually shifts to coho during the third week in July. Pink salmon are abundant during even years, but there is often no market. The southern Subdistricts 5 and 6 (Shaktoolik and Unalakleet) are sustained fisheries. They target chinook, chum, and coho salmon, with chinook and coho catches remaining fairly stable while chum salmon catches have been declining since the early 1980's. Management has consisted of a series of Emergency Orders that open the season, adjust fishing time, restrict mesh size, and occasionally eliminate a fishing period.

Commercial fisheries in Subdistricts 2 and 3 (Golovin and Moses Point) target chum salmon. The commercial chum harvest has dropped dramatically since the mid 1980's. Poor returns has caused very restrictive management actions recently where the seasons have been closed by E.O. to allow for escapement and subsistence needs.

There has been little or no commercial salmon harvests in Subdistricts 1 and 4 (Nome and Koyuk). In the Nome Subdistrict this is due to very depressed stocks which in some years require closure or severe restrictions on the fishery. Conversely, the Koyuk Subdistrict has healthy stocks but can't attract markets willing to operate in this remote area.

Subsistence Fishery Overview

Household subsistence surveys have not been conducted district wide since 1985 in Norton Sound villages due to budgetary restrictions. Recently, the Subsistence Division has been selecting one village each year in which to conduct formal indepth studies of subsistence harvest levels and trends. The information is not used for inseason management, but identifies subsistence needs which must be considered in management decisions.

Daily surveys of Unalakleet River and ocean subsistence fishermen have been conducted annually since 1985 during the chinook salmon run. Although total harvests by subsistence fishers were not documented, effort and catch information were used to judge timing and magnitude of the chinook salmon return. The commercial fishery is delayed until it becomes apparent subsistence needs are being met and chinook salmon are beginning their upstream migration as indicated by the Department of Fish and Game test net in the lower Unalakleet River. There is a growing trend to move subsistence nets from the river mouth out to the ocean in order to avoid large debris loads from spring runoff. It is presently unclear what changes this fishing technique will have on chinook salmon escapement.

Low salmon stock levels in the Nome Subdistrict combined with a large concentration of users has required issuing subsistence harvest permits for the area since 1974. These are issued by regulation to each household and designated fishing location. Each location may have its own catch limit per permit and the fisherman is allowed to change locations after notifying the local Fish and Game office.

Regulatory Actions in Nome Subdistrict

Although pink salmon are usually the most abundant species of salmon in Subdistrict 1 streams, the commercial fishery has targeted chum salmon. The relatively large chum salmon catches in this subdistrict in conjunction with weak local stock abundance implied that the fishery intercepts non-local stocks. A 1978-79 Norton Sound stock separation study confirmed this view. Salmon tagged near Nome were re-captured in fisheries from Golovin (Subdistrict 2) to Kotzebue. In an attempt to provide for spawning requirements in addition to an important subsistence fishery that

targets local stocks, a commercial harvest guideline of 5,000-15,000 chum salmon was adopted as a regulation.

Due to poor chum salmon escapement during the 1982 and 1983 seasons, the Board of Fisheries, in response to an advisory committee petition, directed the Department to manage the commercial fishery so that chum salmon escapement could be optimized. During the 1984 fall Board of Fisheries meetings, these directives became regulation. In response to public and advisory board proposals, the following commercial fishery restrictions were adopted as regulations:

- 1) Salmon may be taken commercially only from July 1 through August 31.
- 2) Fishing periods were restricted to two 24 hour periods per week.
- 3) Waters west of Cape Nome were closed to commercial salmon fishing.

The Department was also directed to allow a harvest at the lower end of the guideline harvest range of 5,000 to 15,000 chum salmon, as stipulated in 5AAC 04.360.

In addition to these commercial fishing restrictions, a proposal to restrict the sport fishery in the Nome and Snake Rivers was adopted in 1984:

With a bag and possession limit of 15 salmon, other than chinook salmon, only 5 could be chum and coho salmon, in combination.

Subsistence permit limits in the Nome and Snake Rivers were restricted to 20 chum and 20 coho salmon. The remainder of the permit limit could be filled with salmon other than chum or coho salmon.

However, even with these restrictive regulations in place, chum salmon escapement goals were difficult to attain. The 1987 fishing season experienced poor returns of both chum and pink salmon to Nome Subdistrict streams. Numerous management actions were made which curtailed commercial fishing activities, and later, sport, personal use, and subsistence were also restricted. Even with such drastic fishery restrictions, escapement goals for chum salmon were not attained during 1987 in the Nome, Eldorado, Flambeau, Bonanza, Snake, and Solomon Rivers. In response to this continuing trend of decreasing chum and pink salmon returns to the Nome Subdistrict, several new regulations were adopted during the 1987 Alaska Board of Fisheries meetings.

With the commercial fishery all but eliminated in recent years, proposals affecting the sport, personal use, and subsistence fisheries were considered. The following new sport fish regulations were adopted for all Nome area road system streams (Seward Peninsula drainages from Cape Prince of Wales to Cape Darby):

- 1) For salmon other than chinook, 10 per day, 10 in possession, only 3 which may be chum salmon and coho salmon, in combination.
- 2) For chinook salmon, 1 per day, 1 in possession.

These new regulations superseded those adopted during 1984. Additional new regulations affecting personal use and subsistence fishermen which were adopted in 1987 included:

- 1) In the Nome River, no person may operate more than 50 feet of gillnet in the aggregate.
- 2) The Nome River was added to the regulation 5AAC 01.170 (e) which states that small mesh gillnets (less than 4 1/2 inch mesh) and beach seines may not be used in specific Nome Subdistrict streams.

Regulation changes in 1992 restricted the use of beach seines in the Nome subdistrict. The managers now have the authority to allow the subsistence harvest of chum or pink salmon by beach seine if escapement needs are likely to be met. Beginning in 1991, no chum salmon harvests have been allowed until escapement goals were likely to be met or conservative management actions were judged to be no longer effective. In the past beach seines were viewed as an overly effective means to harvest fish, but during the last two years, beach seines were used as a means to harvest abundant species, while allowing the live release of other species experiencing depressed runs.

1994 Norton Sound Salmon Fishery

Commercial Fishery Summary

The 1994 Norton Sound District commercial salmon fishing season was first opened by emergency order in the Unalakleet and Shaktoolik Subdistricts on June 20 and ended by regulation on September 7. The commercial salmon harvest totaled 1,108,184 fish which was comprised of 5,285 chinook, 80 sockeye, 102,140 coho, 982,389 pink, and 18,290 chum salmon (Table 1). Approximately 119 permit holders participated in the fishery and received \$864,882 for their catch (Table 2 and 3).

The 1994 Salmon Management Plan for Norton Sound did not allow for chum salmon directed fishing due to conservation concerns. Chinook salmon were targeted early in the season using minimum mesh size restrictions and pink salmon were targeted using maximum mesh size restrictions. Mesh size restrictions were lifted only after the proportion of coho salmon exceeded the proportion of chum salmon in the fishery and chum escapement levels were judged fair to good in most subdistricts. Coho salmon became the target species once the coho return began to increase dramatically and the fishery would have little affect on any additional chum escapement.

Table 1 lists the Norton Sound historical salmon and the current year run strength relative to the previous 5 year (1989-1993) and the previous 10 year (1984-1993) averages. The chinook salmon harvest was 23% below the previous 5 year average and 34% below the previous 10 year average. The coho salmon harvest was the second highest on record at 63% above the previous 5 year average and 104% above the previous 10 year average catches. Historically Norton Sound has had very limited markets for pink salmon. In 1994, a strong pink salmon market developed on a strong pink salmon return. This years pink harvest far exceeded the previous record of 325,503 salmon where it was 2,900% above the previous 5 year average and 2,300% above the previous 10 year average catches. The chum salmon harvest was held to the lowest on record due to conservation concerns. The chum salmon commercial harvest was 72% below the 5 year average and 81% below the 10 year average catches for Norton Sound.

A total of 200 CFEC permits were renewed of which 119 actually fished during the 1994 season (Table 2). The number of participating fishermen this season was 16% below the 10 year average of 142 fishermen. Effort levels typically occur when there is a drop in salmon returns or when prices are low. The northern subdistricts had historically landed approximately 50% of the total commercial chum salmon harvest, but did not participate during that portion of the season due to chum restrictions and markets. In addition, they did not participate in the pink salmon fishery due to long distances required to tender their catch.

Three primary salmon buyers operated in Norton Sound during the 1994 season. Two of the buyers split the early chinook harvest that concentrated in the eastern subdistricts (Subdistricts 5 and 6). The third buyer was the only company to purchase pink salmon and only operated in Norton Sound during the pink season. The company custom processed the pink salmon using pollock fillet machines and packaging then held the product onboard the processing freezer vessel. Pink salmon were tendered between subdistricts and offloaded on the processing vessel. Only one primary buyer remained for the coho salmon portion of the season. Coho salmon were collected at Unalakleet and Nome where they were headed and gutted then frozen before shipped airfreight to Anchorage markets. In addition, a few individual fishermen sold their catch of fresh salmon locally and to wholesale distributors, as permitted under the catcher-seller status. The average price paid for chinook was \$1.02 per pound, \$.49/lb for sockeye, \$.52/lb for coho, \$.15/lb for pink, and \$.29/ for chum salmon. The total value of the raw fish, \$864,882 was 113% above the previous 5 year (1989-1993) average (Table 3).

Subsistence Fishery Summary

There are 10 villages scattered along the coast and the major river systems of Norton Sound from Nome to Stebbins (Figure 2). Nearly all of the local people are dependent to varying degrees on the fish and game resources for their livelihood. Subsistence fishermen operate gillnets or seines in the main rivers and, to a lesser extent, in the coastal marine waters capturing primarily salmon, herring, whitefish, Dolly Varden, pike, and saffron cod. Beach seines are used near the spawning grounds to catch schooling or spawning salmon and other species of fish. The major portion of

fish taken during the summer months is air dried or smoked for later consumption by villagers or their dogs.

Subsistence catch information has been derived from interviews of fishermen, actual counts of fish, and subsistence catch calendars returned by fishermen. Subsistence salmon catches in the Nome Subdistrict (Subdistrict 1) have been determined from the return of catch calendars as required under a permit system. The Department conducted annual surveys of the important subsistence salmon fisheries from the early 1960's until 1982. The majority of salmon taken are pinks and chums. Subsistence harvest information prior to 1960 is incomplete or entirely lacking for many years. Since 1983 budgetary restrictions have made it impossible to conduct systematic surveys in each village as was done from 1964 to 1982. For the last 5 years that complete surveys were conducted for Norton Sound (1978-1982) the average subsistence catch was 71,000 salmon including all species (Table 10). These reported harvests are primarily based on village household surveys. Since not all fishermen are contacted, these harvests should be considered minimum figures.

Low salmon stock levels in the Nome Subdistrict combined with a large concentration of users have required issuing subsistence harvest permits for the area since 1974. These permits identify the body of water to be fished, the type of gear used, and the bag limit which is specific to that body of water. In addition, there is a catch calendar where the permit holder records the catches in numbers of each species of fish for each day fished. If the subsistence fishers have filled their bag limits or would like to fish another location, they can be issued another permit generally for another area after the previous one has been returned. These permits are important to inseason management because they identify users and bag limits, but the actual catch information can not be compiled until well after the season when the permits are returned to Fish and Game.

The Subsistence Division of Fish and Game has recently received money to conduct subsistence surveys in most villages in both the Kotzebue Sound and Norton Sound Districts this fall. The survey will provide 1994 subsistence salmon harvest information and whether or not the users felt their needs were met. In addition, the survey is designed to lay the groundwork for more indepth follow-up surveys should money become available in the future. Preliminary results of these surveys can be found in Appendix Tables A2 through A8.

Season Summary by Subdistrict

Nome - Subdistrict 1. The commercial salmon season was opened by Emergency Order (E.O.) on August 1. This management action which delayed the season was taken in order to avoid the harvest of chum salmon that were expected to return in low numbers to the Nome Subdistrict. Both subsistence and sport fishing in the area were closed prior to the beginning of the chum salmon return. Subsistence fishing restrictions were incremental relaxed on a stream-by-stream basis as chum escapements appeared assured and the pink salmon return developed. An Emergency Order required that all chum salmon captured in beach seines be released throughout the entire season. This allowed fishermen to take advantage of the abundant pinks while protecting the weak chum return.

As stated above, the Nome Subdistrict opened for a directed commercial fishery on coho salmon beginning August 1. Only one fisherman reported any sales and the reason for the low effort was due to poor weather conditions. Unlike other Norton Sound streams, rivers in the Nome Subdistrict were experiencing slow coho returns. On August 8, Emergency Orders restricting subsistence and sport fishing in the Nome area were issued to help bolster coho salmon escapements. The total commercial harvest included 1 sockeye, 287 coho, and 66 chum salmon (Tables 2 and 5). One hundred thirty six subsistence permits were issued for the Nome area. Harvest data will be presented in a later report following the return of the permits.

Golovin Bay - Subdistrict 2. The 1994 Salmon Management Plan informed fishermen that the Golovin Subdistrict commercial harvest would be limited to 10,000 chum salmon in an attempt to protect the chum stock which has been experiencing decreasing returns over the past 6 years. If a pink salmon market were to develop in 1994, a commercial pink fishery would only begin after early aerial surveys indicated that adequate chum salmon escapements would be achieved. The aerial survey flown July 9 indicated that chum escapement goals had been reached. Both fishermen and buyers were notified that a commercial fishery could begin, but there was no interest in fishing periods at the time.

An Emergency Order issued August 1 opened the Golovin Bay Subdistrict to the standard two 48 hour periods per week schedule directed at coho salmon. Good escapements and low fishing effort were the reasons for additional E.O.'s that liberalized fishing in the subdistrict. An E.O. issued August 13 extended fishing period length to 7 days per week which was followed by another E.O. issued August 31 that extended the fishing season to September 7. Five fishermen made sales with a total commercial harvest of 3,424 coho and 111 chum salmon (Table 2 and 6). All the fish were flown to Nome by small aircraft for processing.

Moses Point - Subdistrict 3. The Moses Point Subdistrict has also experienced depressed chum salmon returns in recent years despite conservative management actions. The department notified fishermen during preseason fisherman's meeting and through a mail out of the 1994 Salmon Management Plan that a poor chum salmon return was expected. The prospect for a chum directed fishery was very low. There was the additional possibility of a subsistence closure during the season if the chum escapement levels appear certain to fall short of the Kwiniuk River counting tower goal of 19,500 chum salmon. Attempts would be made to minimize the impact on the subsistence harvest by allowing directed fishing on pink salmon. The return was closely monitored throughout the run at the counting tower.

The commercial fishing season was delayed to assess the chum salmon return strength as outlined in the management plan. The Kwiniuk River chum salmon escapement goal was reached early on July 7 and the pink salmon return was just starting to build. Fishermen

and buyers were informed that a pink directed fishery would be allowed if commercial markets developed and fishermen were interested. The only pink buyer was set up to buy pinks in the Shaktoolik and Unalakleet Subdistrict where the supply of fish already exceeded their processing capacity. As the supply of pinks dwindled in the eastern subdistricts, the run appeared to hold strong at Moses Point, but the buyer had already laid off one tender and the other was out of operation with mechanical problems. The processing vessel could have moved, but the choice was made to stay on low numbers of good quality fish rather than move to an area with potentially higher numbers of pink salmon but of lower market quality.

The Moses Point Subdistrict initially opened on July 25 with its standard two 24 hour periods per week schedule. Early coho abundance was stronger than usual, but fishing effort was lower than normally observed at this time. On August 1, the fisheries outer boundary was extended to improve the product quality. The coho salmon abundance continued to increase which warranted extending the fishing time to two 48 hour periods per week on August 2. The fishing period length was again extended to 7 days per week on August 13 because effort was very low and more flexibility was provided to transport fish out of the subdistrict for processing. The season was extended 7 additional days so that the closure date would be consistent with other subdistricts.

The Moses point total harvest included 5,345 coho and 414 chum salmon (Table 2 and 7). Sales were made by 21 different permits holders. The coho salmon catch was 250% higher than the previous 5 year average and 112% higher than the previous 10 year average. The chum salmon harvest was 58% and 96% below the previous 5 and 10 year averages respectively. Commercial chum salmon harvests have been depressed in the Moses Point Subdistrict since 1988.

Norton Bay - Subdistrict 4. The Norton Bay Subdistrict has always had difficulty attracting a buyer due to its remoteness and reputation for water-marked fish. There were no biological reasons why a limited commercial harvest could not occur on either chinook, coho, or pink salmon, during the 1994 season, but no buyers expressed interest in buying and transporting fish out of the subdistrict. The subdistrict remained closed until August 1 when it was placed on the standard two 48 hour periods per week schedule. This was done to provide opportunity for individual permit holders who might find their own markets. The fishing period length was extended to 7 days per week beginning August 13 and the season was extended by 7 additional days on August 31. There were no reported sales in the Norton Bay Subdistrict for 1994. This was the fourth season out of the last 6 years that no commercial harvest occurred in the subdistrict.

Shaktoolik and Unalakleet - Subdistricts 5 and 6. The Shaktoolik and Unalakleet Subdistricts in recent years have consistently attracted commercial markets due to larger salmon returns and availability of transportation services. These subdistricts are typically

managed as a unit because salmon returning to terminal spawning streams in these subdistricts tend to intermingle and harvest in one subdistrict affects the movement of fish in both subdistricts. The department's test net in the Unalakleet River and daily subsistence interviews at Unalakleet are used to set early chinook salmon fishing periods. As the season progresses, the test net and commercial catch indices are used to assess return strengths of each salmon species. Aerial surveys were not conducted in either subdistrict due to poor conditions in 1994 (Table 4).

The first commercial fishing period in both subdistricts opened on June 20 for 24 hours. It was directed at chinook salmon using a minimum mesh size restriction of 7.5 inches. This was followed by a second 24 hour chinook salmon directed period on June 23. Early test openings on pink salmon took place on June 26 and 29 using maximum mesh size restrictions to avoid chum salmon (4.0 to 4.5 inch mesh). The pink salmon harvest area in each subdistrict was restricted to sections of the coast where pink salmon tend to congregate and chum salmon are found in lower concentrations. The incidental chum salmon catches during the pink salmon directed commercial periods were minimized by utilizing both gear and harvest area restrictions. A third chinook salmon directed period was scheduled between the two pink periods so as to not create gear conflicts, but there was very little effort.

It was determined that the fishermen could easily catch more pinks salmon than the buyer could process in a timely manner while maintaining quality. Based on the apparent strong pink salmon return, the low level of incidental chum catch, and the limited daily processing capacity, the fishing period on June 29 was extended and scheduled to close on July 20. The buyer regulated daily fishing times based on daily production capability and mobility of tenders. Two additional 24 hour chinook salmon directed periods were scheduled on June 29 and July 4. Commercial harvest rates for chinook salmon were decreasing and therefore, no further openings were allowed which targeted that species.

On July 7, a single 48 hour chum salmon directed period was allowed in both subdistricts to test chum salmon run strength and evaluate effort levels. The department's test net in the Unalakleet River indicated that high numbers of chum salmon were passing upstream. At the time, the directed commercial pink salmon fishery was continuing to catch very few chum. No deliveries were made during the special period held on July 7 due to lack of fisherman interest. Consequently, no additional chum periods were scheduled for the remainder of the season. On July 20, the scheduled pink salmon commercial period was extended 3 additional days to July 25 in order to obtain the targeted catch of one million pink salmon. Pink salmon abundance declined dramatically at the time, and the buyer ceased operations on July 23.

Both subdistricts reopened on July 25 for the directed coho salmon fishery. Gear restrictions were set at 6 inch maximum mesh size. No area restrictions were required. The coho salmon directed fishery was opened only after it was observed for several days that coho significantly outnumbered chum salmon in both the incidental pink salmon

commercial fishery and the Unalakleet River test net catches. The coho salmon return was strong and the chum catches were low. On August 31, the period length was extended to 7 days per week for the remainder of the season which closed by regulation on September 7.

Commercial catches in the Shaktoolik Subdistrict included 885 chinook, 45 sockeye, 22,065 coho, 502,231 pink, and 5,411 chum salmon (Table 2 and 8). The chinook salmon harvest was 51% below the previous 5 year average and 56% below the previous 10 year average. The coho salmon harvest was the second highest on record for the subdistrict at 120% and 167% above the 5 and 10 year averages respectively. The pink salmon harvest far exceeded all previous years. Conversely, the chum salmon harvest was the lowest since 1968 at 78% and 75% below both the 5 and 10 year averages respectively.

The Unalakleet Subdistrict commercial harvest included 4,400 chinook, 71 sockeye, 71,019 coho, 480,158 pink, and 12,288 chum salmon (Table 2 and 9). The chinook salmon catch was 9% below the previous 5 year average and 18% below the previous 10 year average. The coho salmon harvest was the second highest on record for the subdistrict at 41% and 90% above the previous 5 and 10 year averages respectively. The pink salmon harvest was also very high at approximately 500% above previous averages. The total chum salmon harvest in the subdistrict was held to 63% below the previous 5 year average and 60% below the previous 10 year average which was the lowest since 1967.

Escapement

Table 4 lists aerial survey and tower escapement counts in the major index streams of Norton Sound. Survey conditions were poor throughout the entire district in 1994. Record levels of pink salmon created species identification problems for aerial surveyors during the peak chum salmon spawning period. Persistent rain caused water levels in area rivers to rise and become turbid in mid July. Additional heavy rains in early August, which when added to the already high water, caused severe flooding. Stream banks were eroded and river channels changed. Water levels did not recede substantially until mid September which was after much of the coho salmon spawning had already taken place. Some early surveys for chum salmon and late surveys for coho salmon were obtained, but have limited value when comparisons are made with previous seasons. The Nome Subdistrict streams received the most intensive survey efforts because salmon stocks local to the Nome area are limited, easily accessed by road system, and exposed to intensive subsistence and sport fishing pressure.

Escapement projects in the Norton Sound District include counting towers on the Kwiniuk, Nome, and Niukluk Rivers and the Unalakleet River test net. Both the Unalakleet test net and the Kwiniuk tower projects have been in operation for many years. They provide comparable and timely information which is greatly relied upon as a basis for inseason salmon management decisions. The Nome River tower first began in late 1993 and was operational throughout 1994

while the Niukluk tower began in late 1994. Both projects have limited historical data that can be used when making comparisons, but will become more valuable the longer they operate.

Chinook Salmon. The Unalakleet and Shaktoolik Subdistricts are the primary chinook salmon producers in Norton Sound. Although on a smaller scale, the Norton Bay, Moses Point and Golovin Subdistricts have experienced a gradually increasing trend of chinook returns in recent years. Aerial escapement surveys were not obtained for chinook in any Norton Sound index areas due to poor survey conditions. Daily subsistence fishermen interviews conducted at Unalakleet, the Department's test fish project in the Unalakleet River, and comparative commercial catch data indicated chinook escapements were only average to slightly below average in the Shaktoolik and Unalakleet Subdistricts. The Kwiniuk River counting tower had a slightly higher than average chinook salmon passage.

Chum Salmon. As stated earlier, chum salmon escapement was difficult to assess this year due to both large numbers of pink salmon and high water conditions. Streams in the Nome Subdistrict were surveyed early with mixed results. Escapements were generally slightly below escapement goals at that time, however, two of the six surveyed streams were at or above their respective goals already. Therefore, it is believed that had survey conditions been better, most streams would have made their chum escapements goals in the Nome area. The Golovin Subdistrict has one primary river system with escapement goals set for individual tributaries. An early aerial survey this season put the chum salmon escapement at 33% above the escapement goal for the combined system which was likely to increase. The Kwiniuk tower produced the only escapement information for the Moses Point Subdistrict. The total chum count at the tower was 33,030 which is 69% above the tower passage goal of 19,500 chum salmon.

No aerial surveys were obtained for the Norton Bay, Shaktoolik, or Unalakleet Subdistricts in 1994 due to weather. Typically, commercial catch data provides an indicator of relative run strength from year to year. Since there was no directed chum fishery this year and no aerial surveys, the Unalakleet test net became the primary index of relative chum abundance for the eastern subdistricts. The test net catch was above average and would indicate that chum escapement was adequate in those subdistricts.

Coho Salmon. Coho salmon are found in nearly all of the chum producing streams throughout Norton Sound with the primary commercial contributors being the Unalakleet and Shaktoolik Rivers. Because of the inclement weather normally experienced in this area during August and September, escapement data for all subdistricts has been difficult to obtain. During the 1994 season, only streams in the northern subdistricts were surveyed and conditions were fair to poor. The Unalakleet test net did not operate due to high water for several days in August. Based on past observations, the coho salmon

tend to avoid high current velocities during peak water levels, therefore it is believed little of the run was missed due to poor conditions.

Overall coho salmon escapements appeared to be above average for much of Norton Sound based on the Unalakleet test net, the Kwiniuk counting tower, and comparable commercial catch statistics. The Nome Subdistrict had mixed survey results. The early surveys indicated low or delayed returns and the late surveys were generally unusable except for the Snake River which had the second highest count on record for that stream. The Nome River tower had passed 695 coho before being washed out in 1994 as compared to a cumulative count of 2,462 coho on the same date in 1993.

No coho surveys were obtained for the Norton Bay, Shaktoolik, or Unalakleet Subdistricts in 1994 due to poor conditions. The Unalakleet test net and the commercial harvest both indicated above average runs. Therefore, coho salmon escapement in the eastern subdistricts was assumed to be adequate. Additionally, no acceptable surveys were obtained for the Golovin and Moses Point Subdistricts. Based on anecdotal information for Golovin, tower counts for Moses Point, and the early initial return of coho to both subdistricts, coho escapement may have been similar to the eastern Norton Sound streams which would imply escapements were also adequate.

Pink Salmon. Pink salmon returns to Norton Sound have recently followed an odd/even year cycle with the even years typically much larger than the odd years. The 1994 pink salmon return equaled or exceeded previous records for nearly all streams in Norton Sound. Only a few aerial surveys were obtained to document the escapement, but again based on anecdotal information, run timing, counting tower data, the Unalakleet test net, and commercial catch statistics, it is believed there was a large surplus of pink salmon well above escapement needs. Even in areas where substantial commercial harvests occurred it was difficult to detect any pulse generated by commercial fishing periods which suggests a return large enough to dampen the effects of the harvest.

Management Concerns

Chum salmon stocks have declined throughout Norton Sound over the past six or seven years with escapements in the northern subdistricts continuing to be a conservation concern. Chum salmon escapements have consistently fallen short of goals even at times when all forms of harvest have been drastically reduced or eliminated. The Nome Subdistrict was closed during nearly the entire chum run to sport, commercial and subsistence fishing for chum. The Golovin and Moses Point Subdistricts both exceeded their escapement goals and could have harvested 10,000 chum salmon each. However, the return sizes were still below historical run magnitudes which allowed typical commercial harvests of 20,000 to 40,000 in each subdistrict. Likewise, both the Shaktoolik and Unalakleet Subdistricts had the smallest commercial catches on record in 1994 and escapements were believed to be good, but not exceptional to the extent accounted for by the

reduced exploitation of the chum salmon return. The low chum salmon returns are no longer simply single age class failures in Norton Sound. Chum salmon returns can be expected to be low for the next several years since the returns will be coming from low parent years. Total chum salmon returns were at best 3/4 strength of historical average return sizes in 1994.

The flood event that followed both chum and pink salmon spawning probably destroyed a significant portion of the eggs by either scouring them out of the stream bed or by suffocation where heavy loads of silt was deposited on the eggs. Two years from now the pink salmon return will give an early indication of what to expect when the chum salmon from the same brood year return in 1998. Even though escapements were good in Norton Sound, the returns from this year may be quite low.

The renewed interest in Norton Sound pink salmon this season, where one fish buyer had adapted his pollock processing equipment to fillet pink salmon, proved very feasible and manageable. In future years, management plans will have to be developed that set exploitation levels and escapement needs, gear and harvest requirements, and consider incidental harvest of other species.

The Unalakleet Subdistrict has experienced a black market fishery for king salmon over the past several years. In order to maintain escapement and provide subsistence opportunity, the legitimate commercial fishery has been cut back by delaying the opening and restricting fishing periods to 24 hours in length. Subsistence fishing has been occasionally restricted in early summer to the lower section of the river in order to prevent the untraditional seining of pools where kings mill. More recently there have been complaints that coho salmon strips are now being illegally marketed outside of the local area. The illegal sale of salmon strips will continue to be a matter of concern in upcoming years.

1995 Outlook

Salmon forecasts and harvest projections for the 1995 commercial salmon season are based on qualitative assessments of brood year returns, subjective determinations of fresh water overwintering survival and ocean survival, and projections of local market conditions. Salmon buyers will probably operate in only half the subdistricts of Norton Sound during 1995. The chinook return is expected to be average with a commercial harvest ranging from 6,000 to 8,000 fish. Pink salmon are anticipated to be strong particularly for the odd year cycle. In recent years, there has been no market for Norton Sound pink salmon and none is expected during 1995. Should a market develop for pink salmon or for any species where a surplus exists, harvests could markedly increase. Generally adequate chum salmon escapements were observed during 1991, indicating an average return of chum salmon is likely. Commercial harvests of chum are expected to range from 20,000 to 80,000, assuming exploitation rates are similar to past years and if inseason assessment of chum returns will provide for adequate escapement and subsistence harvests. The 1994 return and the 1991 coho salmon escapement indicates an above average coho return. Commercial coho salmon harvests are expected to range from 50,000 to 80,000.

Table 1. Norton Sound commercial salmon catch by subdistrict, 1994.

Subdistrict	Chinook	Sockeye	Coho	Pink	Chum	Total
Nome	0	1	287	0	66	354
Golovin	0	0	3,424	0	111	3,535
Moses Poin	0	0	5,345	0	414	5,759
Norton Bay	0	0	0	0	0	0
Shaktoolik	885	8	22,065	502,231	5,411	530,600
Unalakleet	4,400	71	71,019	480,158	12,288	567,936
District Totals	5,285	80	102,140	982,389	18,290	1,108,184

Table 2. Nome area subsistence salmon catches, Norton Sound, 1994.

	Number of Permits			Number of Salmon Harvested					Total
	Issued	Returned	Fished	Chinook	Sockeye	Coho	Pink	Chum	
Marine Waters	57	54	37	20	64	578	1,369	1,442	3,473
Nome River	39	35	22	1	0	80	3,564	78	3,723
Snake River	1	1	0	0	0	0	0	0	0
Eldorado River	12	10	4	0	1	152	132	44	329
Flambeau River	4	3	1	0	0	76	0	0	76
Bonanza River	7	5	1	0	0	0	76	0	76
Safety Sound	2	2	1	1	0	0	0	11	12
Solomon River	9	9	8	0	0	0	875	0	875
Penny River	0	0	0	0	0	0	0	0	0
Cripple Creek	0	0	0	0	0	0	0	0	0
Sinuk River	1	1	0	0	0	0	0	0	0
Feather River	0	0	0	0	0	0	0	0	0
Fish River	1	1	1	0	0	115	0	0	115
Niukluk River	2	2	1	0	0	43	0	0	43
Port Clarence	1	1	1	0	28	0	49	0	77
Kuzitrin River	1	1	0	0	0	0	0	0	0
Pilgrim River	4	4	1	0	6	0	0	0	6
Unknown River	0	0	0	0	0	0	0	0	0
Total	141	129	78	22	99	1,044	6,065	1,575	8,805

Table 3. Salmon survey counts of Norton Sound streams and associated chum salmon escapement goals, 1994.

Stream Name	Chinook	Coho	Sockeye	Pink	Chum	Chum Goal
Salmon L.			4,970			
Glacial L.			1,230			
Sinuk R.	10	307 ^d		492,000	1,140 ^a	4,500
Snake R.		624 ^b		63,860	688 ^a	1,000
Nome R.	41	1,263 ^c		141,116 ^c	2,974 ^c	2,000 ^g
Flambeau R.	1			290	4,960	3,250
Eldorado R.	2	242 ^d		53,890	5,140 ^a	5,250
Bonanza R.				20 ^c		1,500
Solomon R.		184 ^d		53,600		550
Fish R.	55 ^c			910,000 ^c	16,500 ^{c & a}	17,500
Boston Cr.	95 ^c			355,600 ^c	4,270 ^{c & a}	2,500
Niukluk R.	7 ^c	274 ^d		1,294,100 ^c	16,470 ^{c & a}	8,000
Ophir Cr.		197 ^d				
Kwiniuk R.	627 ^c	2,841 ^{c & c}		2,303,112 ^c	33,010 ^c	19,500 ^r
Tubutulik R.						12,000
Inglutalik R.						8,500
Ungalik R.		No surveys due to poor conditions.				2,500
Shaktoolik R.						11,000
Unalakeet R.						
North R.						2,000
Old Woman R.						100

Note: A multitude of factors affect escapement estimates. The numbers above are strict values that are instantaneous counts which may not truly represent the strength of the return. Refer to text for an evaluation of the return.

^a Species identification difficult where large numbers of pinks salmon were observed.

^b Counts should be considered minimums due to counting conditions.

^c Early count.

^d Late count.

^e Preliminary expanded tower counts.

^r Chum goal for tower count.

^g Chum goal for aerial survey. Tower count goal not yet developed.

Table 4. Commercial salmon set gillnet catches from Nome, Subdistrict 1, Norton Sound, 1994.

Period Number	Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort						Cumulative Catch and Catch Per Unit Effort					
				Chinook	Sockeye	Coho	CPUE	Chum	CPUE	Chinook	Sockeye	Coho	CPUE	Chum	CPUE
1 Coho	8/01-8/02	24	No one fished												
2 Coho	8/04-8/05	24	1	0	1	123	5.13	62	2.58	0	1	123	5.13	62	2.58
3 Coho	8/08-8/9	24	No one fished							0	1	123	5.13	62	2.58
4 Coho	8/11-8/12	24	No one fished							0	1	123	5.13	62	2.58
5 Coho	8/15-8/16	24	No one fished							0	1	123	5.13	62	2.58
6 Coho	8/18-8/19	24	No one fished							0	1	123	5.13	62	2.58
7 Coho	8/22-8/23	24	No one fished							0	1	123	5.13	62	2.58
8 Coho	8/25-8/26	24	1	0	0	164	6.83	4	0.17	0	1	287	5.98	66	1.38
9 Coho	8/29-8/30	24	No one fished							0	1	287	5.98	66	1.38

All salmon sold as permitted under Catcher/Seller status.

No pink salmon were sold.

Total Hours fished = 48

Total number of permits used = 1

Table 5. Commercial salmon set gillnet catches from Golovin, Subdistrict 2, Norton Sound, 1994.

Period Number	Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort						Cumulative Catch and Catch Per Unit Effort					
				Chinook	Sockeye	Coho	CPUE	Chum	CPUE	Chinook	Sockeye	Coho	CPUE	Chum	CPUE
1 Coho	8/01-8/03	48	No one fished												
2 Coho	8/04-8/06	48	4	0	0	806	4.2	54	0.28			806	4.20	54	0.28
3 Coho	8/08-8/10	48	5	0	0	548	2.28	22	0.09			1354	3.13	76	0.18
4 Coho	8/11-8/12	30	4	0	0	353	2.94	8	0.07			1707	3.09	84	0.15
5 Coho	8/13	24	No one fished									1707	3.09	84	0.15
6 Coho	8/14	24	4	0	0	314	3.27	1	0.01			2021	3.12	85	0.13
7 Coho	8/15	24	3	0	0	92	1.28	0	0			2113	2.93	85	0.12
8 Coho	8/16	24	1	0	0	11	0.46	0	0			2124	2.85	85	0.11
9 Coho	8/17	24	1	0	0	73	3.04	0	0			2197	2.86	85	0.11
10 Coho	8/18	24	No one fished									2197	2.86	85	0.11
11 Coho	8/19	24	No one fished									2197	2.86	85	0.11
12 Coho	8/20	24	No one fished									2197	2.86	85	0.11
13 Coho	8/21	24	1	0	0	35	1.46	1	0.04			2232	2.82	86	0.11
14 Coho	8/22	24	3	0	0	143	1.99	1	0.01			2375	2.75	87	0.10
15 Coho	8/23	24	4	0	0	206	2.15	6	0.06			2581	2.69	93	0.10
16 Coho	8/24	24	5	0	0	350	2.92	12	0.1			2931	2.71	105	0.10
17 Coho	8/25	24	3	0	0	99	1.38	1	0.01			3030	2.63	106	0.09
18 Coho	8/26	24	1	0	0	27	1.13	1	0.04			3057	2.60	107	0.09
19 Coho	8/27	24	2	0	0	67	1.4	0	0			3124	2.55	107	0.09
20 Coho	8/28	24	2	0	0	95	1.98	4	0.08			3219	2.53	111	0.09
21 Coho	8/29	24	2	0	0	129	2.69	0	0			3348	2.54	111	0.08
22 Coho	8/30	24	1	0	0	36	1.5	0	0			3384	2.52	111	0.08
23 Coho	8/31	24	1	0	0	28	1.17	0	0			3412	2.49	111	0.08
24 Coho	9/01	24	1	0	0	12	0.5	0	0			3424	2.46	111	0.08
25 Coho	9/02	24	No one fished									3424	2.46	111	0.08
26 Coho	9/03	24	No one fished									3424	2.46	111	0.08
27 Coho	9/04	24	No one fished									3424	2.46	111	0.08
28 Coho	9/05	24	No one fished									3424	2.46	111	0.08
29 Coho	9/06	24	No one fished									3424	2.46	111	0.08
30 Coho	9/07	18	No one fished									3424	2.46	111	0.08

Total Hours fished = 510

Total number of permits used = 5

Table 6. Commercial salmon set gillnet catches from Moses Point, Subdistrict 3, Norton Sound, 1994.

Period Number	Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort						Cumulative Catch and Catch Per Unit Effort					
				Chinook	Sockeye	Coho	CPUE	Chum	CPUE	Chinook	Sockeye	Coho	CPUE	Chum	CPUE
1 Coho	7/25-7/26	24	7	0	0	104	0.62	85	0.51	0	0	104	0.62	85	0.51
2 Coho	7/28-7/29	24	6	0	0	190	1.32	25	0.17	0	0	294	0.94	110	0.35
3 Coho	8/01-8/03	48	8	0	0	410	1.07	13	0.03	0	0	704	1.01	123	0.18
4 Coho	8/04-8/06	48	14	0	0	894	1.33	25	0.04	0	0	1598	1.17	148	0.11
5 Coho	8/08-8/10	48	5	0	0	223	0.93	0	0	0	0	1821	1.13	148	0.09
6 Coho	8/11-8/12	30	0	No one fished						0	0	1821	1.13	148	0.09
7 Coho	8/13	24	0	No one fished						0	0	1821	1.13	148	0.09
8 Coho	8/14	24	1	0	0	31	1.29	0	0	0	0	1852	1.13	148	0.09
9 Coho	8/15	24	2	0	0	133	2.77	4	0.08	0	0	1985	1.18	152	0.09
10 Coho	8/16	24	0	No one fished						0	0	1985	1.18	152	0.09
11 Coho	8/17	24	0	No one fished						0	0	1985	1.18	152	0.09
12 Coho	8/18	24	0	No one fished						0	0	1985	1.18	152	0.09
13 Coho	8/19	24	0	No one fished						0	0	1985	1.18	152	0.09
14 Coho	8/20	24	0	No one fished						0	0	1985	1.18	152	0.09
15 Coho	8/21	24	4	0	0	157	1.64	4	0.04	0	0	2142	1.21	156	0.09
16 Coho	8/22	24	7	0	0	476	2.83	19	0.11	0	0	2618	1.35	175	0.09
17 Coho	8/23	24	8	0	0	621	3.23	23	0.12	0	0	3239	1.52	198	0.09
18 Coho	8/24	24	5	0	0	173	1.44	7	0.06	0	0	3412	1.51	205	0.09
19 Coho	8/25	24	8	0	0	246	1.28	32	0.17	0	0	3658	1.49	237	0.10
20 Coho	8/26	24	6	0	0	163	1.13	11	0.08	0	0	3821	1.47	248	0.10
21 Coho	8/27	24	7	0	0	124	0.74	7	0.04	0	0	3945	1.43	255	0.09
22 Coho	8/28	24	7	0	0	196	1.17	24	0.14	0	0	4141	1.41	279	0.10
23 Coho	8/29	24	5	0	0	279	2.33	23	0.19	0	0	4420	1.45	302	0.10
24 Coho	8/30	24	5	0	0	96	0.8	5	0.04	0	0	4516	1.43	307	0.10
25 Coho	8/31	24	6	0	0	133	0.92	7	0.05	0	0	4649	1.40	314	0.09
26 Coho	9/01	24	8	0	0	128	0.67	10	0.05	0	0	4777	1.36	324	0.09
27 Coho	9/02	24	5	0	0	45	0.38	6	0.05	0	0	4822	1.33	330	0.09
28 Coho	9/03	24	6	0	0	70	0.49	15	0.1	0	0	4892	1.30	345	0.09
29 Coho	9/04	24	9	0	0	133	0.62	15	0.07	0	0	5025	1.26	360	0.09
30 Coho	9/05	24	8	0	0	140	0.73	17	0.09	0	0	5165	1.24	377	0.09
31 Coho	9/06	24	7	0	0	134	0.8	26	0.15	0	0	5299	1.22	403	0.09
32 Coho	9/07	18	4	0	0	46	0.64	11	0.15	0	0	5345	1.21	414	0.09

Total Hours fished = 666

Total number of permits used = 21

Table 7. Commercial salmon set gillnet catches from Shaktoolik, Subdistrict 5, Norton Sound, 1994.

Period Number	Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort								Cumulative Catch and Catch Per Unit Effort							
				Chinook	CPUE	Sockeye	Coho	CPUE	Chum	CPUE	Pink	CPUE	Chinook	CPUE	Sockeye	Coho	CPUE	Chum	Pink
1 King	6/20-6/21	24	19	520	1.14	0	0	0.00	0	0.00	0	0.00	520	1.14	0	0	0	0	
2 King	6/23-6/24	24	18	291	0.67	0	0	0.00	50	0.12	0	0.00	811	0.91	0	0	50	0	
Pink 1	6/26-6/27	18	17	26	0.09	0	0	0.00	161	0.59	27,566	90.08	839	0.94	0	0	231	27,566 90.08	
3 King	6/27-6/28	24	1	14	0.58	0	0	0.00	0	0.00	0	0.00	853	0.94	0	0	231	27,566	
Pink 2	6/29	18	10	0	0.00	0	0	0.00	7	0.04	11,095	61.64	853	0.94	0	0	238	38,661 79.55	
Pink 3	6/30	24	21	3	0.01	0	0	0.00	14	0.03	33,894	67.25	856	0.94	0	0	252	72,555 73.29	
4 King	6/30-7/01	24	No one fished										856	0.94	0	0	252	72,555 73.29	
Pink 4	7/01	24	22	18	0.03	0	0	0.00	37	0.07	43,949	83.24	874	0.96	0	0	289	116,504 76.75	
Pink 5	7/02	24	21	1	0.00	0	0	0.00	28	0.06	45,880	91.03	875	0.96	0	0	317	162,384 80.31	
Pink 6	7/03	24	No one fished										875	0.96	0	0	317	162,384 80.31	
Pink 7	7/04	24	25	2	0.00	0	0	0.00	48	0.08	34,266	57.11	877	0.96	0	0	365	196,650 75.00	
5 King	7/04-7/05	24	No one fished										877	0.96	0	0	365	196,650	
Pink 8	7/05	24	19	1	0.00	0	0	0.00	289	0.63	34,511	75.68	878	0.96	0	0	654	231,161 75.10	
Pink 9	7/06	24	No one fished										878	0.96	0	0	654	231,161 75.10	
Pink 10	7/07	24	No one fished										878	0.96	0	0	654	231,161 75.10	
6 Chum	7/7-7/9	48	No one fished										878	0.96	0	0	654	231,161	
Pink 11	7/08	24	No one fished										878	0.96	0	0	654	231,161 75.10	
Pink 12	7/09	24	16	0	0.00	0	1	0.00	8	0.02	46,255	120.46	878	0.96	0	1	662	277,416 80.13	
Pink 13	7/10	24	6	0	0.00	0	0	0.00	0	0.00	10,167	70.60	878	0.96	0	1	662	287,583 79.75	
Pink 14	7/11	24	21	0	0.00	0	0	0.00	0	0.00	51,971	103.12	878	0.96	0	1	662	339,554 82.62	
Pink 15	7/12	24	24	0	0.00	0	6	0.01	15	0.03	51,154	88.81	878	0.96	0	7	677	390,708 83.38	
Pink 16	7/13	24	No one fished										878	0.96	0	7	677	390,708 83.38	
Pink 17	7/14	24	22	0	0.00	0	9	0.02	51	0.10	39,716	58.17	878	0.96	0	16	728	421,424 80.83	
Pink 18	7/15	24	No one fished										878	0.96	0	16	728	421,424 80.83	
Pink 19	7/16	24	20	0	0.00	1	18	0.04	69	0.14	17,168	35.77	878	0.96	1	34	797	438,592 77.03	
Pink 20	7/17	24	7	0	0.00	0	30	0.18	50	0.30	9,507	56.59	878	0.96	1	64	847	448,099 76.44	
Pink 21	7/18	24	13	0	0.00	0	23	0.07	125	0.40	23,718	76.02	878	0.96	1	87	972	471,817 76.42	
Pink 22	7/19	24	2	0	0.00	0	0	0.00	0	0.00	392	8.17	878	0.96	1	87	972	472,209 75.89	
Pink 23	7/20	24	12	0	0.00	0	38	0.13	40	0.14	12,633	43.86	878	0.96	1	125	1,012	484,842 74.48	
Pink 24	7/21	24	12	1	0.00	0	81	0.28	109	0.38	17,389	60.38	879	0.96	1	206	1,121	502,231 73.88	
Pink 25	7/22	24	No one fished										879	0.96	1	206	1,121	502,231	
Pink 26	7/23	18	No one fished										879	0.96	1	206	1,121	502,231	
7 Coho	7/25-7/27	48	11	2	0.00	1	4,153	7.87	1,353	2.56			881	0.96	2	4,359	2,474	502,231	
8 Coho	7/28-7/31	48	18	4	0.00	3	6,954	8.05	1,348	1.56	0	0.00	885	0.96	5	11,313	8.13	3,822	502,231
9 Coho	8/01-8/03	48	14	0	0.00	0	2,713	4.04	387	0.58	0	0.00	885	0.96	5	14,026	6.80	4,209	502,231
10 Coho	8/04-8/06	48	16	0	0.00	0	1,231	1.60	250	0.33	0	0.00	885	0.96	5	15,257	5.39	4,459	502,231
11 Coho	8/08-8/10	48	16	0	0.00	0	549	0.71	112	0.15	0	0.00	885	0.96	5	15,806	4.39	4,571	502,231
12 Coho	8/11-8/13	48	No one fished										885	0.96	5	15,806	4.39	4,571	502,231
13 Coho	8/15-8/17	48	18	0	0.00	1	1,990	2.30	157	0.18	0	0.00	885	0.96	6	17,796	3.99	4,728	502,231
14 Coho	8/18-8/20	48	10	0	0.00	0	285	0.59	57	0.12	0	0.00	885	0.96	6	18,081	3.66	4,785	502,231
15 Coho	8/22-8/24	48	17	0	0.00	0	1,395	1.71	134	0.16	0	0.00	885	0.96	6	19,476	3.38	4,919	502,231
16 Coho	8/25-8/27	48	12	0	0.00	2	694	1.20	31	0.05	0	0.00	885	0.96	8	20,170	3.18	4,950	502,231
17 Coho	8/29-8/30	54	10	0	0.00	0	1,001	1.85	260	0.48	0	0.00	885	0.96	8	21,171	3.08	5,210	502,231
18 Coho	9/01	24	6	0	0.00	0	186	1.29	63	0.44	0	0.00	885	0.96	8	21,357	3.04	5,273	502,231
19 Coho	9/02	24	6	0	0.00	0	187	1.30	55	0.38	0	0.00	885	0.96	8	21,544	3.01	5,328	502,231
20 Coho	9/03	24	9	0	0.00	0	130	0.60	22	0.10	0	0.00	885	0.96	8	21,674	2.94	5,350	502,231
21 Coho	9/04	24	8	0	0.00	0	270	1.41	50	0.26	0	0.00	885	0.96	8	21,944	2.90	5,400	502,231
22 Coho	9/05	24	No one fished										885	0.96	8	21,944	2.90	5,400	502,231
23 Coho	9/06	24	No one fished										885	0.96	8	21,944	2.90	5,400	502,231
24 Coho	9/07	18	2	0	0.00	0	121	3.36	11	0.31	0	0.00	885	0.96	8	22,065	2.90	5,411	502,231

Total Hours fished = 1092

Total number of permits used = 39

Table 8. Commercial salmon set gillnet catches from Unalakleet, Subdistrict 6, Norton Sound, 1994.

Period Catch and Catch Per Unit Effort												Cumulative Catch and Catch Per Unit Effort								
Period Number	Period Dates	Hours Fished	No. of Fishermen	Chinook	CPUE	Sockeye	Coho	CPUE	Chum	CPUE	Pink	CPUE	Chinook	CPUE	Sockeye	Coho	CPUE	Chum	Pink	CPUE
1 King	6/20-6/21	24	42	1,173	1.16	0	1	0.00	118	0.12	0	0.00	1,173	1.16	0	1		118	0	
2 King	6/23-6/24	24	47	1,323	1.17	1	0	0.00	200	0.18	0	0.00	2,496	1.17	1	1		318	0	
Pink 1	6/26-6/27	18	32	154	0.27	0	0	0.00	155	0.27	60,526	105.08	2,650	1.24	1	1		473	60,526	105.08
3 King	6/27-6/28	24	22	947	1.79	0	0	0.00	284	0.54	0	0.00	3,597	1.35	1	1		757	60,526	
Pink 2	6/29	18	10	2	0.01	0	0	0.00	8	0.04	10,471	58.17	3,599	1.35	1	1		765	70,997	93.91
Pink 3	6/30	24	11	8	0.03	0	0	0.00	11	0.04	18,822	71.30	3,607	1.35	1	1		776	89,819	88.06
4 King	6/30-7/01	24	40	446	0.46	0	0	0.00	256	0.27	85	0.09	4,053	1.12	1	1		1,032	89,904	
Pink 4	7/01	24	4	0	0.00	0	0	0.00	0	0.00	3,922	40.85	4,053	1.12	1	1		1,032	93,826	84.07
Pink 5	7/02	24	17	0	0.00	0	0	0.00	48	0.12	25,869	63.40	4,053	1.12	1	1		1,080	119,695	78.54
Pink 6	7/03	24	No one fished			0							4,054	1.12	1	1		1,087	119,695	78.54
Pink 7	7/04	24	22	1	0.00	0	0	0.00	7	0.01	34,838	65.98	4,339	1.20	4	2		1,329	154,533	75.31
5 King	7/04-7/05	24	25	285	0.48	3	1	0.00	242	0.40	0	0.00	4,339	1.20	4	2		1,329	154,533	
Pink 8	7/05	24	8	2	0.01	0	0	0.00	157	0.82	18,756	97.69	4,341		4	2		1,486	173,289	77.22
Pink 9	7/06	24	No one fished										4,341		4	2		1,486	173,289	77.22
Pink 10	7/07	24	No one fished										4,341		4	2		1,486	173,289	77.22
6 Chum	7/7-7/9	48	No one fished										4,341		4	2		1,486	173,289	
Pink 11	7/08	24	No one fished										4,341		4	2		1,486	173,289	77.22
Pink 12	7/09	24	6	1	0.01	0	0	0.00	8	0.06	11,675	81.08	4,342		4	2		1,494	184,964	77.46
Pink 13	7/10	24	15	0	0.00	0	0	0.00	7	0.02	26,919	74.78	4,342		4	2		1,501	211,883	77.10
Pink 14	7/11	24	14	1	0.00	0	0	0.00	2	0.01	23,911	71.16	4,343		4	2		1,503	235,794	76.46
Pink 15	7/12	24	30	0	0.00	0	1	0.00	27	0.04	41,616	57.80	4,343		4	3		1,530	277,410	72.93
Pink 16	7/13	24	No one fished										4,343		4	3		1,530	277,410	72.93
Pink 17	7/14	24	25	1	0.00	0	17	0.03	30	0.05	48,337	80.56	4,344		4	20		1,560	325,747	73.97
Pink 18	7/15	24	No one fished										4,344		4	20		1,560	325,747	73.97
Pink 19	7/16	24	30	0	0.00	0	2	0.00	24	0.03	45,978	63.86	4,344		4	22		1,584	371,725	72.55
Pink 20	7/17	24	22	0	0.00	0	7	0.01	14	0.03	34,688	65.70	4,344		4	29		1,598	406,413	71.91
Pink 21	7/18	24	19	1	0.00	1	48	0.11	323	0.71	32,184	70.58	4,345		5	77		1,921	438,597	71.81
Pink 22	7/19	24	No one fished										4,345		5	77		1,921	438,597	71.81
Pink 23	7/20	24	17	3	0.01	1	299	0.73	124	0.30	20,266	49.67	4,348		6	376		2,045	458,863	70.42
Pink 24	7/21	24	17	0	0.00	0	163	0.40	103	0.25	17,798	43.62	4,348		6	539		2,148	476,661	68.84
Pink 25	7/22	24	No one fished										4,348		6	539		2,148	476,661	68.84
Pink 26	7/23	18	6	4	0.04	13	139	1.29	66	0.61	3,497	32.38	4,352		19	678		2,214	480,158	68.28
7 Coho	7/25-7/27	48	44	12	0.01	13	9,306	4.41	2,636	1.25	0	0.00	4,364		32	9,984	4.73	4,850	480,158	
8 Coho	7/28-7/31	48	47	14	0.01	26	8,405	3.73	1,382	0.61	0	0.00	4,378		58	18,389	4.21	6,232	480,158	
9 Coho	8/01-8/03	48	48	7	0.00	7	12,495	5.42	2,173	0.94	0	0.00	4,385		65	30,884	4.63	8,405	480,158	
10 Coho	8/04-8/06	48	52	6	0.00	1	12,256	4.91	1,402	0.56	0	0.00	4,391		66	43,140	4.71	9,807	480,158	
11 Coho	8/08-8/10	48	50	2	0.00	1	4,120	1.72	734	0.31	0	0.00	4,393		67	47,260	4.09	10,541	480,158	
12 Coho	8/11-8/13	48	25	4	0.00	1	5,210	4.34	642	0.54	0	0.00	4,397		68	52,470	4.11	11,183	480,158	
13 Coho	8/15-8/17	48	30	2	0.00	1	2,458	1.71	150	0.10	0	0.00	4,399		69	54,928	3.87	11,333	480,158	
14 Coho	8/18-8/20	48	17	0	0.00	0	1,153	1.41	45	0.06	0	0.00	4,399		69	56,081	3.73	11,378	480,158	
15 Coho	8/22-8/24	48	24	0	0.00	2	4,185	3.63	212	0.18	0	0.00	4,399		71	60,266	3.73	11,590	480,158	
16 Coho	8/25-8/27	48	16	0	0.00	0	1,224	1.59	43	0.06	0	0.00	4,399		71	61,490	3.63	11,633	480,158	
17 Coho	8/29-8/30	54	16	0	0.00	0	2,339	2.71	155	0.18	0	0.00	4,399		71	63,829	3.58	11,788	480,158	
18 Coho	9/01	24	16	0	0.00	0	1,594	4.15	98	0.26	0	0.00	4,399		71	65,423	3.60	11,886	480,158	
19 Coho	9/02	24	24	0	0.00	0	1,839	3.19	153	0.27	0	0.00	4,399		71	67,262	3.58	12,039	480,158	
20 Coho	9/03	24	22	0	0.00	0	1,241	2.35	67	0.13	0	0.00	4,399		71	68,503	3.55	12,106	480,158	
21 Coho	9/04	24	18	0	0.00	0	786	1.82	50	0.12	0	0.00	4,399		71	69,289	3.51	12,156	480,158	
22 Coho	9/05	24	16	0	0.00	0	628	1.64	49	0.13	0	0.00	4,399		71	69,917	3.48	12,205	480,158	
23 Coho	9/06	24	17	0	0.00	0	583	1.43	49	0.12	0	0.00	4,399		71	70,500	3.44	12,254	480,158	
24 Coho	9/07	18	16	1	0.00	0	519	1.80	34	0.12	0	0.00	4,400		71	71,019	3.41	12,288	480,158	

Trs fished = 1230
 T per of permits used = 71

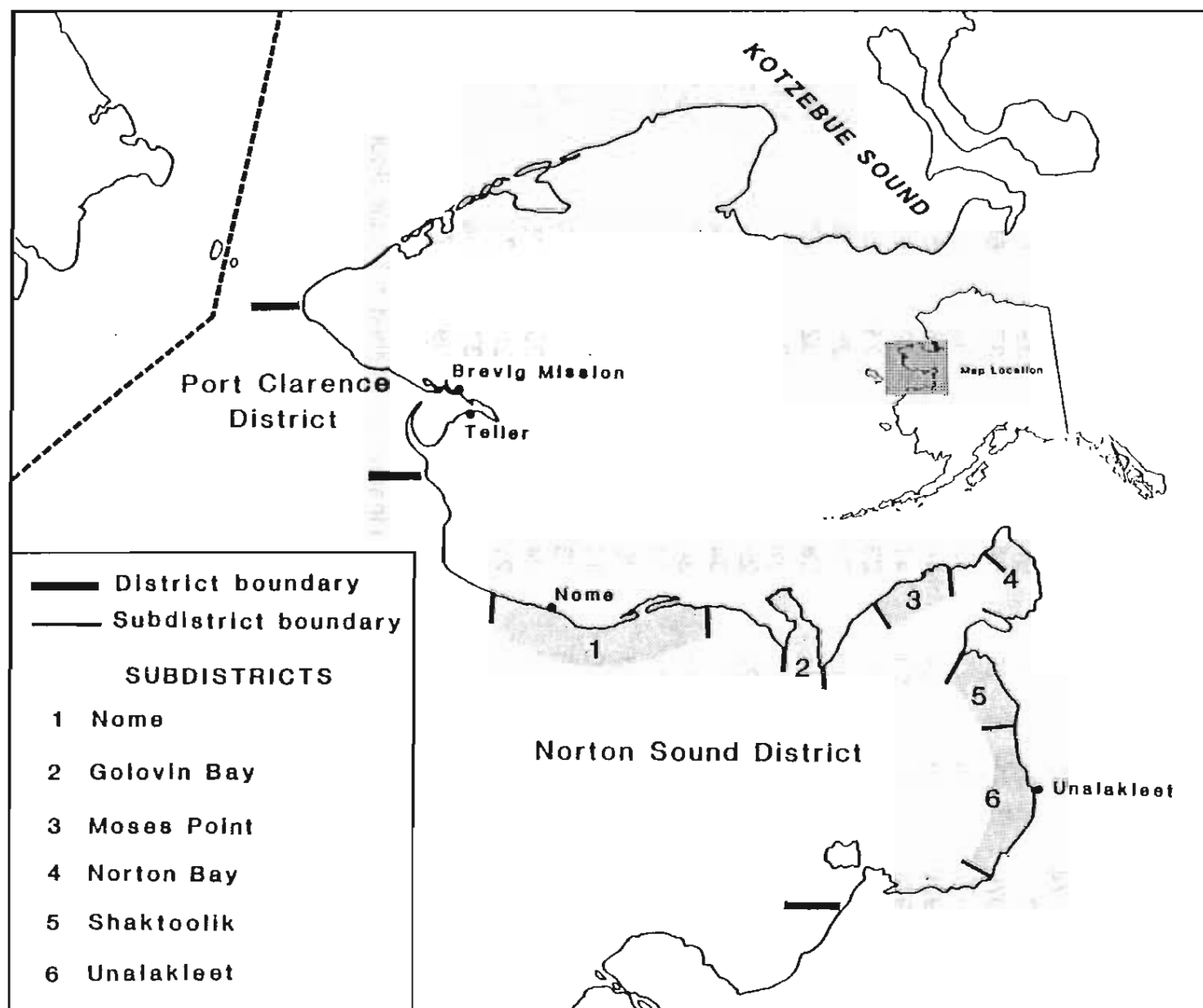


Figure 1. Norton Sound commercial salmon fishing subdistricts.

Appendix Table A1. Number of commercial salmon fishermen fishing in Norton Sound, 1970 - 1994.

Year	SUBDISTRICT					District		a
	1	2	3	4	5	6	Totals	
1970	6	33	21	0	12	45		b
1971	7	22	45	6	19	72		b
1972	20	20	48	32	20	71		b
1973	21	34	57	30	27	94		b
1974	25	25	60	8	23	53		b
1975	24	42	67	42	39	61		b
1976	21	22	54	27	37	60		b
1977	14	25	52	24	30	45	164	
1978	16	24	44	26	26	51	176	
1979	15	21	41	22	29	63	175	
1980	14	17	26	13	26	66	159	
1981	15	19	33	10	26	73	167	
1982	18	17	28	10	32	68	164	
1983	19	21	39	15	34	72	170	
1984	8	22	25	8	24	74	141	
1985	9	21	34	12	21	64	155	
1986	13	24	34	9	30	73	163	
1987	10	21	34	12	39	65	164	
1988	5	21	36	13	21	69	152	
1989	2	0	13	0	26	73	110	
1990	0	15	23	0	28	73	128	
1991	0	16	24	0	25	75	126	
1992	2	1	21	9	25	71	110	
1993	1	8	26	15	37	66	153	
1994	1	5	21	0	39	71	119	

a District total is the number of fishermen that actually fished in Norton Sound; Some fishermen may have fished more than one subdistrict.

b Data not available

Appendix Table Commercial and subsistence salmon catches by species, by year in Nome Subdistrict, Nome District, 1964-1994.

NOME (SUBDISTRICT 1)																		
Commercial							Subsistence						Combined					
Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1964	5	-	-	1	1194	1200	-	-	-	-	-	-	5	-	-	1	1194	1200
1965	1	-	-	193	1941	2135	-	-	-	780	1825	2605	1	-	-	973	3766	4740
1966	1	-	32	1	581	615	12	-	192	1794	1762	3760	13	-	224	1795	2343	4375
1967	-	-	-	72	406	478	11	-	36	349	627	1023	11	-	36	421	1033	1501
1968	-	-	-	50	102	152	7	-	108	6507	621	7243	7	-	108	6557	723	7395
1969	-	-	63	330	601	994	2	-	27	3649	508	4186	2	-	90	3979	1109	5180
1970	-	-	6	55	960	1021	-	-	35	5001	458	5494	0	-	41	5056	1418	6515
1971	11	-	-	14	2315	2340	-	-	122	5457	2900	8479	11	-	122	5471	5215	10819
1972	15	-	-	12	2643	2670	19	-	52	4684	315	5070	34	-	52	4696	2958	7740
1973	-	-	-	321	1132	1453	14	-	120	5108	1863	7105	14	-	120	5429	2995	8558
1974	19	-	123	7722	10431	18295	8	-	5	3818	183	4014	27	-	128	11540	10614	22309
1975	2	-	319	2163	8364	10848	2	-	97	6267	2858	9224	4	-	416	8430	11222	20072
1976	2	10	26	1331	7620	8989	13	-	189	5492	1705	7399	15	10	215	6823	9325	16388
1977	8	-	58	65	15998	16129	35	-	498	2773	12192	15498	43	-	556	2838	28190	31627
1978	19	-	-	22869	8782	31670	35	-	225	13063	4295	17618	54	-	225	35932	13077	49288
1979	9	-	29	5860	5391	11289	11	-	1120	6353	3273	10757	20	-	1149	12213	8664	22046
1980	8	-	-	10007	13922	23937	129	-	2157	22246	5983	30515	137	-	2157	32253	19905	54452
1981	4	-	508	3202	18666	22380	35	14	1726	5584	8579	15938	39	14	2234	8786	27245	38318
1982	20	-	1183	18512	13447	33162	21	6	1829	19202	4831	25889	41	6	3012	37714	18278	59051
1983	23	-	261	308	11691	12283	74	53	1911	8086	7091	17215	97	53	2172	8394	18782	29498
1984	7	-	820	-	3744	4571	83	16	1795	17182	4883	23959	90	16	2615	17182	8627	28530
1985	21	-	356	-	6219	6596	56	114	1054	2117	5667	9008	77	114	1410	2117	11886	15604
1986	6	-	50	-	8160	8216	150	107	688	8720	8085	17750	156	107	738	8720	16245	25966
1987	3	-	577	-	5646	6226	200	107	1100	1251	8394	11052	203	107	1677	1251	14040	17278
1988	2	-	54	182	1628	1866	63	133	1076	2159	5952	9383	65	133	1130	2341	7580	11249
1989	2	-	-	123	492	617	24	131	469	924	3399	4947	26	131	469	1047	3891	5564
1990	0	-	0	0	0	0	58	234	510	2233	4246	7281	58	234	510	2233	4246	7281
1991	0	0	0	0	0	0	83	166	1279	194	3715	5437	83	166	1279	194	3715	5437
1992	1	2	693	185	881	1762	152	163	1481	7351	1684	10831	153	165	2174	7538	2585	12593
1993	0	2	611	0	132	745	52	80	2070	873	1766	4841	52	82	2681	873	1898	5588
1994	0	1	287	0	66	354	23	69	983	6556	1673	9304	23	70	1270	6556	1739	9658
5-year avg.	1	-	261	62	301	625	74	155	1162	2315	2962	6667	74	156	1423	2377	3263	7292
10-year avg.	4	-	316	49	2690	3060	92	125	1152	4300	4779	10449	96	126	1468	4349	7469	13509
1989-1993																		
1989-1993																		

Appendix Table A3. Commercial and subsistence salmon catches by species, by year in Golovin Subdistrict, Norton Sound District, 1962-1994.

GOLOVIN BAY (SUBDISTRICT 2)																		
Commercial							Subsistence						Combined					
Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1962	45	11	264	10276	68720	79316	-	-	-	-	-	-	45	11	264	10276	68720	79316
1963	40	40	-	19677	49850	69607	-	-	118	5702	9319	15139	40	40	118	25379	59169	84746
1964	27	40	3	7236	58301	65607	-	-	-	-	-	-	27	40	3	7236	58301	65607
1965	-	-	-	-	-	-	2	-	49	1523	3847	5421	2	-	49	1523	3847	5421
1966	17	14	584	4665	29791	35071	4	-	176	1573	3520	5273	21	14	760	6238	33311	40344
1967	10	-	747	5790	31193	37740	3	-	185	2774	4803	7765	13	-	932	8564	35996	45505
1968	12	-	205	18428	10011	28656	4	-	181	4955	1744	6884	16	-	386	23383	11755	35540
1969	28	-	1224	23208	20949	45409	2	-	190	2760	2514	5466	30	-	1414	25968	23463	50875
1970	13	-	3	18721	20566	39303	4	-	353	2046	2614	5017	17	-	356	20767	23180	44320
1971	37	-	197	2735	33824	36793	7	-	191	1544	1936	3678	44	-	388	4279	35760	40471
1972	36	-	20	6562	27097	33715	4	-	62	1735	2028	3829	40	-	82	8297	29125	37544
1973	70	-	183	14145	41689	56067	1	-	48	9	74	132	71	-	231	14154	41763	56219
1974	30	-	3	28340	30173	58546	3	-	-	967	205	1175	33	-	3	29307	30378	59721
1975	17	-	206	10770	41761	52754	-	-	1	2011	2025	4037	17	-	207	12781	43786	56791
1976	12	-	1311	24051	30219	55593	-	-	-	1995	1128	3123	12	-	1311	26046	31347	58716
1977	26	-	426	7928	53912	62292	3	-	80	703	2915	3701	29	-	506	8631	56827	65993
1978	22	-	94	72033	41462	113611	1	-	-	2470	1061	3532	23	-	94	74503	42523	117143
1979	75	49	1606	45948	30201	77879	-	-	845	2546	2840	6231	75	49	2451	48494	33041	84110
1980	36	36	328	10774	52609	63783	12	-	692	10727	4057	15488	48	36	1020	21501	56666	79271
1981	23	5	13	49755	58323	108119	8	-	1520	5158	5543	12229	31	5	1533	54913	63866	120348
1982	78	5	4281	39510	51970	95844	7	-	1289	4752	1868	7916	85	5	5570	44262	53838	103760
1983	52	10	295	17414	48283	66054	-	-	-	-	-	-	-	-	-	-	-	-
1984	31	-	2462	88588	54153	145234	-	-	-	-	-	-	-	-	-	-	-	-
1985	193	113	1196	3019	55781	60302	12	2	430	1904	8577	11925	205	115	1626	4923	65358	72227
1986	8181	8	958	25425	69725	104297	-	-	-	-	-	-	-	-	-	-	-	-
1987	166	51	2203	1579	44334	48333	-	-	-	-	-	-	-	-	-	-	-	-
1988	108	921	2149	31559	33348	68085	-	-	-	-	-	-	-	-	-	-	-	-
1989	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
1990	52	21	0	0	15993	16066	-	-	-	-	-	-	-	-	-	-	-	-
1991	49	1	0	0	14839	14889	-	-	-	-	-	-	-	-	-	-	-	-
1992	6	9	2085	0	1002	3102	-	-	-	-	-	-	-	-	-	-	-	-
1993	1	4	2	8480	2803	11290	-	-	-	-	-	-	-	-	-	-	-	-
1994	0	0	3424	0	111	3535	89	163	707	8022	1070	10051	7159	7322	8029	12627	13697	23637
5-year avg.	22	-	417	1696	6927	9069	-	-	-	-	-	-	-	-	-	-	-	-
10-year avg.	879	-	1106	15865	29198	47160	-	-	-	-	-	-	-	-	-	-	-	-

1988-1993
1983-1993
Subsistence survey not conducted.
Harvest estimated from Div. of Subsistence survey.

Appendix Table A4. Commercial and subsistence salmon catches by species, by year in Moses Point Subdistrict, Nelson Sound District, 1962-1994.

MOSES POINT (SUBDISTRICT 3)																		
Commercial							Subsistence						Combined					
Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1962	27	-	-	11100	50683	61810	-	-	-	-	-	-	27	0	0	11100	50683	61810
1963	15	-	-	2549	46274	48838	5	-	-	5808	8316	14129	20	0	0	8357	54590	62967
1964	32	3	-	3372	28568	31975	-	-	-	63	348	411	32	3	0	3435	28916	32386
1965	-	-	-	-	-	-	16	-	72	1325	9857	11270	16	-	72	1325	9857	11270
1966	17	-	-	2745	24741	27503	14	-	250	2511	5409	8184	31	0	250	5256	30150	35687
1967	-	-	-	-	-	-	39	-	116	1322	9913	11390	39	-	116	1322	9913	11390
1968	12	-	1	9012	17908	26933	2	-	80	6135	2527	8744	14	-	81	15147	20435	35677
1969	29	-	-	11807	26594	38430	9	-	109	1790	1303	3211	38	-	109	13597	27897	41641
1970	39	-	-	13052	29726	42817	16	-	160	4661	6960	11797	55	-	160	17713	36686	54614
1971	95	-	4	922	43831	44852	16	-	271	1046	2227	3560	111	-	275	1968	46058	48412
1972	190	-	11	5866	30919	36986	44	-	108	1579	2070	3801	234	-	119	7445	32989	40787
1973	134	-	-	10603	31389	42126	2	-	-	-	298	300	136	-	0	10603	31687	42426
1974	198	-	9	12821	55276	68304	3	-	-	2382	1723	4108	201	-	9	15203	56999	72412
1975	16	-	-	4407	46699	51122	2	-	6	1280	508	1796	18	-	6	5687	47207	52918
1976	24	-	232	5072	10890	16218	22	-	-	5016	1548	6586	46	-	232	10088	12438	22804
1977	96	-	6	9443	47455	57000	22	-	225	1145	1170	2562	118	-	231	10588	48625	59562
1978	444	-	244	39694	44595	84977	38	-	407	1995	1229	3669	482	-	651	41689	45824	88646
1979	1035	-	177	40811	37123	79146	16	-	890	6078	1195	8179	1051	0	1067	46889	38318	87325
1980	502	-	-	1435	14755	16682	131	-	229	4232	1393	5985	633	0	229	5667	16148	22677
1981	198	-	5	26417	29325	55945	32	-	2345	6530	2819	11726	230	0	2350	32947	32144	67671
1982	253	-	318	9849	40030	50450	1	-	1835	3785	3537	9158	254	0	2153	13634	43567	59608
1983	254	-	-	17027	65776	83057	-	-	-	-	-	-	-	-	-	-	-	-
1984	-	-	5959	28035	9477	43471	-	-	-	-	-	-	-	-	-	-	-	-
1985	816	32	1803	559	24466	27676	67	-	1389	1212	947	3615	883	32	3192	1771	25413	31291
1986	600	41	5874	15795	20668	42978	-	-	-	-	-	-	-	-	-	-	-	-
1987	907	15	64	568	17278	18832	-	-	-	-	-	-	-	-	-	-	-	-
1988	663	93	3974	13703	18585	37018	-	-	-	-	-	-	-	-	-	-	-	-
1989	62	-	-	-	167	229	-	-	-	-	-	-	-	-	-	-	-	-
1990	202	-	-	501	3723	4426	-	-	-	-	-	-	-	-	-	-	-	-
1991	161	0	0	0	804	965	312	-	2153	3555	2660	8680	473	-	2153	3555	3464	9645
1992	0	0	3531	0	6	3537	100	-	1281	6152	1260	8793	100	-	4812	6152	1266	12330
1993	3	0	4065	0	167	4235	368	-	1217	1726	1635	4946	371	-	5282	1726	1802	9181
1994	0	0	5345	0	414	5759	308	100	1135	9001	3173	13717	308	-	6480	9001	3587	19476
5-year avg.	86	0	1519	100	973	2678	-	-	-	-	-	-	-	-	-	-	-	-
10-year avg.	341	18	2527	5916	9534	18337	-	-	-	-	-	-	-	-	-	-	-	-

1989-1993

1984-1993

* Subsistence survey not conducted.

* Harvest estimated from Div. of Subsistence survey.

Appendix Table A5. Commercial and subsistence salmon catches by species, by year in Norton Bay Subdistrict, Norton Sound District, 1962-1994.

NORTON BAY (SUBDISTRICT 4)																		
Commercial							Subsistence						Combined					
Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1962	387	7	40	4402	24380	29216	-	-	-	-	-	-	387	7	40	4402	24380	29216
1963	137	2	-	17676	12469	30284	-	-	-	5097	-	5097	137	2	-	22773	12469	35381
1964	50	3	-	988	5916	6957	-	-	-	-	-	-	50	3	-	988	5916	6957
1965	-	-	-	-	-	-	4	-	22	252	3032	3310	4	-	22	252	3032	3310
1966	-	-	-	-	-	-	7	-	41	929	3612	4589	7	-	41	929	3612	4589
1967	-	-	-	-	-	-	12	-	14	1097	2945	4068	12	-	14	1097	2945	4068
1968	-	-	-	-	-	-	28	-	71	1916	1872	3887	28	-	71	1916	1872	3887
1969	26	-	-	4849	3974	8849	59	-	189	2115	3855	6218	85	-	189	6964	7829	15067
1970	-	-	-	-	-	-	3	-	10	840	3500	4353	3	-	10	840	3500	4353
1971	-	-	-	-	-	-	5	-	47	92	2619	2763	5	-	47	92	2619	2763
1972	43	-	-	1713	7799	9555	30	-	44	2089	2022	4185	73	-	44	3802	9821	13740
1973	28	-	-	1645	4672	6345	1	-	-	10	130	141	29	-	-	1655	4802	6486
1974	21	-	-	654	3826	4501	-	-	-	17	900	917	21	-	-	671	4728	5418
1975	68	-	89	1137	17385	18679	1	-	-	93	361	455	69	-	89	1230	17746	19134
1976	102	-	95	4456	7161	11814	2	-	-	41	236	279	104	-	95	4497	7397	12093
1977	158	-	1	2495	13563	16217	14	-	-	420	2055	2489	172	-	1	2915	15618	18706
1978	470	-	144	8471	21973	31058	12	-	21	1210	1060	2303	482	-	165	9681	23033	33361
1979	856	-	2547	6201	15599	25203	12	-	697	735	1400	2844	868	-	3244	6936	16999	28047
1980	340	-	-	47	7855	8242	22	-	33	4275	1132	5462	362	-	33	4322	8987	13704
1981	63	-	-	177	3111	3351	7	-	82	2314	3515	5918	70	-	82	2491	6626	9269
1982	96	-	2332	2535	7128	12091	1	-	484	2600	2485	5570	97	-	2816	5135	9613	17661
1983	215	-	204	3935	17157	21511	-	-	-	-	-	-	-	-	-	-	-	-
1984	-	-	-	1162	3442	4604	-	-	-	-	-	-	-	-	-	-	-	-
1985	528	-	384	68	9948	10928	-	-	-	-	-	-	-	-	-	-	-	-
1986	139	2	1512	40	1994	3687	-	-	-	-	-	-	-	-	-	-	-	-
1987	544	-	145	16	3586	4291	-	-	-	-	-	-	-	-	-	-	-	-
1988	434	2	709	1749	7521	10415	-	-	-	-	-	-	-	-	-	-	-	-
1989	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
1990	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
1991	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
1992	27	0	0	0	1787	1814	-	-	-	-	-	-	-	-	-	-	-	-
1993	267	0	0	290	1378	1935	-	-	-	-	-	-	-	-	-	-	-	-
1994	0	0	0	0	0	0	278	1	334	5454	4130	10197	-	-	-	-	-	-
5-year avg.	59	0	0	58	633	750	-	-	-	-	-	-	-	-	-	-	-	-
10-year avg.	194	0	275	333	2966	3767	-	-	-	-	-	-	-	-	-	-	-	-

1989-1993

1984-1993

Subsistence survey not conducted.

No commercial harvest reported.

Harvest estimated from Div. of Subsistence survey.

Appendix Table A6. Commercial and subsistence salmon catches by species, by year in Shaktoolik Subdistrict, Non-Indian District, 1961-1994.

SHAKTOOLIK (SUBDISTRICT 5)																		
Year	Commercial						Subsistence						Combined					
	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1961	140	-	-	29075	24746	53961	-	-	-	-	-	-	140	-	-	29075	24746	53961
1962	1738	-	2113	640	8718	13209	-	-	-	-	-	-	1738	-	2113	640	8718	13209
1963	480	11	563	5138	19153	25345	-	-	-	-	-	-	480	11	563	5138	19153	25345
1964	631	79	16	1969	35272	37967	77	-	340	2132	5412	7961	708	79	356	4101	40684	45928
1965	127	30	-	3	8356	8516	31	-	107	3763	3420	7321	158	30	107	3766	11776	15837
1966	310	-	956	344	8292	9902	142	-	762	1445	4183	6532	452	-	1718	1789	12475	16434
1967	43	-	88	1050	1655	2836	262	-	387	2010	4436	7095	305	-	475	3060	6091	9931
1968	61	-	130	2205	2504	4900	10	-	458	6355	1915	8738	71	-	588	8560	4419	13638
1969	33	-	276	6197	8645	15151	40	-	193	4018	3439	7690	73	-	469	10215	12084	22841
1970	197	-	155	2301	15753	18406	43	-	210	2474	2016	4743	240	-	365	4775	17769	23149
1971	284	-	238	28	13399	13949	87	-	329	494	5060	5970	371	-	567	522	18459	19919
1972	419	-	11	2798	12022	15250	64	-	235	939	3399	4637	483	-	246	3737	15421	19887
1973	289	-	177	6450	14500	21416	51	-	130	3410	1397	4988	340	-	307	9860	15897	26404
1974	583	-	179	5650	26391	32803	93	-	353	1901	358	2705	676	-	532	7551	26749	35508
1975	651	2	812	1774	49536	52775	18	-	14	1394	334	1760	669	2	826	3168	49870	54535
1976	892	-	129	15803	15798	32622	24	-	121	1188	269	1602	916	-	250	16991	16067	34224
1977	1521	4	418	7743	36591	46277	49	-	170	585	2190	2994	1570	4	588	8328	38781	49271
1978	1339	7	1116	46236	35388	84086	81	-	15	3275	1170	4541	1420	7	1131	49511	36558	88627
1979	2377	-	3383	18944	22030	46734	62	-	1605	2575	1670	5912	2439	-	4988	21519	23700	52646
1980	1088	-	8001	1947	27453	38487	57	-	756	3227	1827	5867	1143	-	8757	5174	29280	44354
1981	1484	4	1191	29695	21097	53471	8	-	525	2225	3490	6248	1492	4	1716	31920	24587	59719
1982	1677	3	22233	17019	26240	67172	68	-	2138	3865	1165	7236	1745	3	24371	20884	27405	74408
1983	2742	4	12877	12031	67310	94964	-	-	-	-	-	-	-	-	-	-	-	-
1984	1613	-	10730	1596	32309	46248	-	-	-	-	-	-	-	-	-	-	-	-
1985	5312	-	2808	-	13403	21523	298	-	1379	24	298	1999	5610	-	4187	24	13701	23522
1986	1075	29	6626	-	16126	23856	-	-	-	-	-	-	-	-	-	-	-	-
1987	2214	-	6193	-	14088	22495	-	-	-	-	-	-	-	-	-	-	-	-
1988	671	79	6096	3681	21521	32048	-	-	-	-	-	-	-	-	-	-	-	-
1989	1241	43	8066	-	19641	28991	-	-	-	-	-	-	-	-	-	-	-	-
1990	2644	49	4695	-	21748	29136	-	-	-	-	-	-	-	-	-	-	-	-
1991	1324	55	11614	-	31619	44612	-	-	-	-	-	-	-	-	-	-	-	-
1992	1098	56	14860	-	27867	43681	-	-	-	-	-	-	-	-	-	-	-	-
1993	2756	20	11130	106743	20864	141513	-	-	-	-	-	-	-	-	-	-	-	-
1994	885	8	22065	502231	5411	530600	1100	1	2600	8550	1143	13394	1985	9	24665	510781	6554	543994
5-year avg.	1813	45	10933	21349	24348	57587	-	-	-	-	-	-	-	-	-	-	-	-
10-year avg.	1995	33	8262	11202	21919	43410	-	-	-	-	-	-	-	-	-	-	-	-

1989-1993

1984-1993

Subsistence survey not conducted.

Harvest estimated from Div. of Subsistence survey.

Appendix Table A7. Commercial and subsistence salmon catches by species, by year in Unalakleet Subdistrict, Norton Sound District, 1961-1994.

UNALAKLEET (SUBDISTRICT 6)																		
Commercial							Subsistence						Combined					
Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1961	5160	35	13807	5162	23586	47750	-	-	-	-	-	-	5160	35	13807	5162	23586	47750
1962	5089	-	6739	6769	30283	48880	-	-	-	-	-	-	5089	-	6739	6769	30283	48880
1963	5941	18	16202	1140	27003	50304	-	-	-	-	-	-	5941	18	16202	1140	27003	50304
1964	1273	1	79	1	19611	20965	488	-	2227	7030	6726	16471	1761	1	2306	7031	26337	37436
1965	1321	-	2030	24	26498	29873	521	-	4562	11488	8791	25362	1842	-	6592	11512	35289	55235
1966	1208	-	4183	5023	16840	27254	90	-	789	6083	3387	10349	1298	-	4972	11106	20227	37603
1967	1751	-	1544	21961	8502	33758	490	-	484	9964	-	10938	2241	-	2028	31925	8502	44696
1968	960	-	6549	41474	14865	63848	186	-	1493	11044	2982	15705	1146	-	8042	52518	17847	79553
1969	2276	-	5273	40558	22032	70139	324	-	1483	4230	4196	10233	2600	-	6756	44788	26228	80372
1970	1604	-	4261	30779	40029	76673	495	-	3907	10104	7214	21720	2099	-	8168	40883	47243	98393
1971	2166	-	2688	1196	37543	43593	911	-	3137	2230	7073	13351	3077	-	5825	3426	44616	56944
1972	2235	-	412	28231	20440	51318	643	-	1818	3132	4132	9725	2878	-	2230	31363	24572	61043
1973	1397	-	8922	13335	25716	49370	323	-	213	6233	3426	10195	1720	-	9135	19588	29142	59565
1974	2100	-	1778	93332	36170	133380	313	-	706	7341	588	8948	2413	-	2484	100673	36758	142328
1975	1638	-	3167	12137	48740	65682	163	-	74	4758	2038	7033	1801	-	3241	16895	50778	72715
1976	1211	1	5141	37203	24268	67824	142	-	694	4316	2832	7984	1353	1	5835	41519	27100	75808
1977	2691	1	2781	21001	32936	59410	723	-	1557	8870	6085	17235	3414	1	4338	29871	39021	76645
1978	7525	5	5737	136200	37079	186546	1044	-	2538	13268	3442	20292	8569	5	8275	149468	40521	206838
1979	6354	8	23696	49647	30445	110150	640	-	3330	6960	1597	12527	6994	8	27026	56807	32042	122677
1980	4339	3	21512	203142	64198	293194	1046	-	4758	19071	5230	30105	5385	3	26270	222213	69428	323299
1981	6157	47	29845	123233	39186	198468	869	24	5808	5750	4235	16686	7026	71	35653	128983	43421	215154
1982	3768	2	61343	142856	44520	252489	913	2	7037	20045	4694	32691	4681	4	68380	162901	49214	285180
1983	7022	13	36098	26198	109220	178551	1868	33	6888	13808	4401	26998	8890	46	42986	40006	113621	205549
1984	6804	6	47904	-	43317	98031	1650	1	6675	17418	3348	29092	8454	7	54579	17418	46665	127123
1985	12621	21	15421	1	25111	53175	1397	3	2244	55	1968	5667	14018	24	17665	56	27079	58842
1986	4494	153	20580	-	30239	55466	-	-	-	-	-	-4	-	-	-	-	-	-
1987	3246	141	15097	97	17525	36106	-	-	-	-	-	-4	-	-	-	-	-	-
1988	2218	157	24232	23730	25363	75700	-	-	-	-	-	-4	-	-	-	-	-	-
1989	4402	222	36025	-	20825	61474	-	-	4681	17500	1388	-9	-	-	-	-	-	-
1990	5998	358	52015	-	23659	82030	2476	-	-	-	-	-4	-	-	-	-	-	-
1991	4534	147	52033	-	39609	96323	-	-	-	-	-	-4	-	-	-	-	-	-
1992	3409	229	84449	6284	52547	146918	-	-	-	-	-	-4	-	-	-	-	-	-
1993	5944	251	26290	42061	28156	102702	-	-	-	-	-	-4	-	-	-	-	-	-
1994	4400	71	71019	480158	12288	567936	4282	644	13124	26726	9635	54411	8682	715	84143	506884	21923	622347
5-year avg.	4857	241	50162	9669	32959	97889	-	-	-	-	-	-	-	-	-	-	-	-
10-year avg.	5367	169	37405	7217	30635	80793	-	-	-	-	-	-	-	-	-	-	-	-

1989-1993

1984-1993

Subsistence catches from 1966-72 includes fish taken at St. Michael.

Subsistence surveys not conducted.

In-depth survey by Subsistence Division.

Harvest estimate from Div. of Subsistence survey.

Appendix Table A8. Commercial and subsistence salmon catches by species, by year for all subdistricts in Norton Sound District, 1961-1994.

ALL SUBDISTRICTS																		
Commercial							Subsistence						Combined					
Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1961	5300	35	13807	34327	48332	101801	-	-	-	-	-	-	5300	35	13807	34327	48332	101801
1962	7286	18	9156	33187	182784	232431	-	-	-	-	-	-	7286	18	9156	33187	182784	232431
1963	6613	71	16765	55625	154789	233863	5	-	118	16807	17635	34365	6618	71	16883	72232	172424	268228
1964	2018	126	98	13567	148862	164671	565	-	2567	9225	12486	24843	2583	126	2665	22792	161348	189514
1965	1449	30	2030	220	36795	40524	574	-	4812	19131	30772	55289	2023	30	6842	19351	67567	95813
1966	1553	14	5755	12778	80245	100345	269	-	2210	14335	21873	38687	1822	14	7965	27113	102118	139032
1967	1804	-	2379	28879	41756	74818	817	-	1222	17516	22724	42279	2621	-	3601	46395	84480	117097
1968	1045	-	6885	71179	45300	124409	237	-	2391	36912	11661	51201	1282	-	9276	108091	56961	175610
1969	2392	-	6836	86949	82795	178972	436	-	2191	18562	15615	36804	2828	-	9027	105511	98410	215776
1970	1853	-	4423	64908	107034	178218	561	-	4675	26127	22763	54126	2414	-	9098	91035	129797	232344
1971	2593	-	3127	4895	131362	141977	1026	197	4097	10863	21618	37801	3619	197	7224	15758	152980	179778
1972	2938	-	454	45182	100920	149494	804	93	2319	14158	13873	31247	3742	-	2773	59340	114793	180741
1973	1918	-	9282	46499	119098	176797	392	-	520	14770	7185	22867	2310	-	9802	61269	126283	199664
1974	2951	-	2092	148519	162267	315829	420	-	1064	16426	3958	21868	3371	-	3156	164945	166225	337697
1975	2393	2	4593	32388	212485	251861	186	11	192	15803	8113	24305	2579	13	4785	48191	220598	276186
1976	2243	11	6934	87919	95956	193063	203	-	1004	18048	7718	26973	2446	11	7938	105967	103674	220036
1977	4500	5	3690	48675	200455	257325	846	-	2530	14296	26607	44279	5346	5	6220	62971	227062	301604
1978	9819	12	7335	325503	189279	531948	1211	-	2981	35281	12257	51730	11030	12	10316	360784	201536	583678
1979	10706	57	31438	167411	140789	350401	747	-	8487	25247	11975	46456	11453	57	39925	192658	152764	396857
1980	6311	40	29842	227352	180792	444337	1397	-	8625	63778	19622	93422	7708	40	38467	291130	200414	537759
1981	7929	56	31562	232479	169708	441734	2021	38	13416	28741	32866	77082	9950	94	44978	261220	202574	518816
1982	5892	10	91690	230281	183335	511208	1011	8	14612	54249	18580	88460	6903	18	106302	284530	201915	599668
1983	10308	27	49735	76913	319437	456420	-	-	-	-	-	-	-	-	-	-	-	-
1984	8455	6	67875	119381	146442	342159	-	-	-	-	-	-	-	-	-	-	-	-
1985	19491	166	21968	3647	134928	180200	-	-	-	-	-	-	-	-	-	-	-	-
1986	6395	233	35600	41260	146912	230400	-	-	-	-	-	-	-	-	-	-	-	-
1987	7080	207	24279	2260	102457	136283	-	-	-	-	-	-	-	-	-	-	-	-
1988	4096	1252	37214	74604	107966	225132	-	-	-	-	-	-	-	-	-	-	-	-
1989	5707	265	44091	123	42625	92811	-	-	-	-	-	-	-	-	-	-	-	-
1990	8895	434	56712	501	65123	131665	-	-	-	-	-	-	-	-	-	-	-	-
1991	6068	203	63647	-	86871	156789	-	-	-	-	-	-	-	-	-	-	-	-
1992	4541	296	105418	6284	83394	199933	-	-	-	-	-	-	-	-	-	-	-	-
1993	8972	279	43283	157574	53562	263670	-	-	-	-	-	-	-	-	-	-	-	-
1994	5285	80	102140	982389	18290	1108184	6080	978	18883	64309	20824	111074	11365	1058	121023	1046698	39114	1219258
5-year avg.	6837	295	62630	32896	66315	168974	-	-	-	-	-	-	-	-	-	-	-	-
10-year avg.	7970	334	50009	40563	97028	195904	-	-	-	-	-	-	-	-	-	-	-	-

1989-1993

1984-1993

* These figures also include data from Stebbins and St. Michael.

* Subsistence surveys not conducted.

* Harvest estimate from Div. of Subsistence survey.

Year	Chinook	Chum	Pink	Pink & Chum	Coho
Boston Creek					
1963	67	1,669	-	-	-
1964	10	3,315	-	-	-
1966	153	761	-	-	-
1968	7	2,500	2,500	-	-
1969	100	7,000	16,000	-	-
1970	246	8,200	12,900	-	-
1971	42	7,045	80	-	-
1972	57	4,252	3,950	-	-
1973	153	3,014	3,213	-	-
1974	231	2,426	749	-	-
1975	147	1,885	2,556	-	-
1977	76	1,325	385	-	-
1978	136	2,655	74,221	-	-
1979	58	882	271	-	-
1980	16	2,450	1,510	-	-
1982	10	1,730	22,020	-	-
1983	154	704	-	-	-
1984	35	-	-	47,850	-
1985	243	3,450	-	-	-
1986	2	220	0	-	-
1987	583	3,640	0	-	-
1988	163	1,040	7,400	-	-
1989	-	-	-	-	-
1990	-	1,455	8,440	-	-
1991	152	2,550	3,210	-	-
1992	68	1,540	803,200	-	-
1993	227	4,513	1,930	-	-
1994	95	4,270	355,600	-	-
Niukluk River					
1962	11	-	-	27,879	-
1963	1	13,687	4,103	-	-
1964	-	8,395	10,495	-	-
1966	-	21,300	8,600	4,700	-
1967	-	20,546	-	-	-
1968	-	-	-	87,085	-
1969	-	10,240	92,650	-	-
1970	-	7,300	60,350	-	-
1971	-	22,605	8,370	-	-
1972	-	10,500	22,600	-	-
1973	-	14,365	14,790	-	-
1974	1	8,720	8,915	-	-
1975	-	10,089	16,258	-	-
1976	-	4,130	7,190	-	-
1977	19	10,456	4,150	-	-
1978	2	14,365	208,300	-	-
1979	8	10,127	30,147	-	-
1980	-	8,915	75,770	-	-
1981	-	7,249	-	-	-
1982	20	2,557	227,540	-	-
1983	54	8,886	50	-	-
1984	6	-	-	57,208	3,072
1985	25	11,140	-	-	332
1986	2	2,442	0	-	-
1987	10	4,145	0	-	257
1988	18	6,501	8,160	-	1,095
1989	-	-	-	-	182
1990	-	6,200	-	-	170
1991	24	10,660	37,410	-	1,783
1992	-	7,770	803,200	-	812
1993	15	19,910	2,840	-	2,104
1994	7	16,470	1,294,100	-	274

-Continued-

Year	Chinook	Chum	Pink	Pink & Chum	Coho
Kwiniuk River					
1962	3	-	-	23,249	-
1963	2	11,340	3,779	-	-
1964	-	14,533	-	-	-
1965 d	14	26,634	8,301	-	-
1966 d	7	32,786	10,629	-	-
1967 d	13	24,444	3,508	-	-
1968 d	27	18,813	126,764	-	-
1969 d	12	19,687	56,683	-	-
1970 d	-	68,004	235,131	-	-
1971 d	37	39,046	16,742	-	-
1972 d	65	30,686	62,461	-	-
1973 d	57	28,617	38,420	-	-
1974 d	62	35,899	40,816	-	-
1975 d	44	14,344	57,317	-	-
1976 d	12	6,977	29,471	-	-
1977 d	84	22,757	46,234	-	-
1978 d	74	14,408	72,270	-	-
1979 d	107	12,355	167,492	-	-
1980 d	177	19,374	320,389	-	-
1981 d	136	34,561	566,417	-	-
1982 d	138	44,036	469,674	-	-
1983 d	267	56,907	251,965	-	-
1984 d	736	54,043	736,544	-	983 r
1985 d	712	9,912	22,548	-	673 r
1986 d	653	24,704	241,446	-	421
1987 d	314	16,134	5,567	-	819 r
1988 d	321	13,301	187,904	-	444 r
1989 d	282	13,689	30,275	-	-
1990 d	744	13,735	404,452	-	746 r
1991 d	587	18,802	54,591	-	809 r
1992 d	479	12,077	1,464,717	-	532 r
1993 d	565	15,823	43,065	-	1,238
1994 d	627	33,010	2,303,112	-	2,841
Tubutulik River					
1962	3	-	-	16,690	-
1963	9	16,069	4,355	-	-
1964	-	15,469	10,043	3,420	-
1966	-	5,514	26,000	-	-
1967	1	-	-	22,475	-
1969	3	12,040	12,788	3,045	-
1970	-	53,290	136,590	-	-
1971	-	16,820	7,500	5,065	-
1972 c	-	8,070	21,100	-	-
1973	131	5,383	15,665	-	-
1974	136	9,560	17,940	-	-
1975	7	17,141	38,003	-	-
1976	-	1,095	6,095	2,600	-
1977	-	8,540	4,685	-	-
1978	2	5,865	1,364	-	-
1979	-	812	1,624	-	-
1980 s	405	21,616	663,937	-	-
1982 c	49	2,044	53,605	-	-
1983	135	16,345	40,790	-	-
1984	139	56,210	93,600	-	-
1985	472	13,645	8,940	-	-
1986	453	5,975	35,680	-	-
1987	474	9,605	580	-	-
1988	561	4,660	114,450	-	-
1989 c	-	-	-	-	-
1990	397	4,350	186,400	-	-
1991	661	7,085	26,870	-	-
1992	260	2,595	138,600	-	-
1993	1,061	8,740	18,650	-	1,395
1994	No survey due to poor conditions				

-Continued-

Year	Chinook	Chum	Pink	Pink & Chum ^b	Coho
North River					
1962	162	-	-	16,087	-
1963 ^c	287	-	-	73,274	-
1964	23	-	-	5,981	-
1965	153	-	-	16,600	-
1970 ^c	1	20,655	12,400	-	-
1971 ^c	256	-	-	1,047	-
1972 ^d	561	2,332	54,934	-	-
1973 ^d	298	4,332	26,542	-	-
1974 ^d	220	861	154,285	-	-
1975 ^c	60	5,237	17,885	-	-
1976 ^c	66	196	10,606	-	-
1977	1,275	8,139	4,565	-	-
1978	321	9,349	21,813	-	-
1979	735	1,130	9,500	-	-
1980	61	2,300	127,900	-	204
1981	68	405	575	-	263
1982	8	599	173,352	-	4,145
1983	347	4,135	4,980	-	-
1984 ^d	2,844	2,915	458,387	-	152 ^f
1985 ^d	1,426	4,567	4,360	-	2,045
1986 ^d	1,613	3,738	236,487	-	-
1987	445	392	0	-	680
1988	202	30	112,770 ⁱ	-	240
1989 ^c	-	-	-	-	-
1990	255	510	25,685	-	-
1991	656	2,435	118,720	-	2,510
1992	329	-	631,140	-	398
1993	900	445	13,570	-	1,397
1994	No survey due to poor conditions				

^a Represents "high count" for season.

^b Surveyor unable to distinguish between the two species.

^c Poor survey conditions or partial survey, poor counting tower conditions.

^d Total counts obtained from counting tower.

^e Combined tower and aerial survey counts below the tower.

^f Aerial survey; not tower count.

^g Helicopter survey.

^h Boat survey.

ⁱ Foot survey.

^j Includes counts from Casadepaga and Ophir Creeks.

^k Includes counts from Ophir Creek.

^l Numerous pink salmon made enumerating of chum salmon difficult; pink count may include some chum.

Appendix Table A10.

Estimated mean prices paid to commercial
salmon fishermen, Norton Sound District,
1962 - 1994.

Year	Chinook	Coho	Pink	Chum
Price Per Fish				
1962	\$3.85	\$0.60	\$0.25	\$0.35
1963	\$3.85	\$0.60	\$0.25	\$0.35
1964	\$4.50	-	\$0.25	\$0.40
1965	\$3.75	\$0.45	-	\$0.40
1966	\$4.80	\$1.05	\$0.25	\$0.65
Price Per Pound				
1967	\$0.20	\$0.14	\$0.07	\$0.09
1968	\$0.25	\$0.14	\$0.06	\$0.10
1969	\$0.22	\$0.14	\$0.06	\$0.11
1970	\$0.25	\$0.14	\$0.06	\$0.10
1971	\$0.25	\$0.14	\$0.07	\$0.10
1972	\$0.27	\$0.16	\$0.06	\$0.11
1973	\$0.40	\$0.16	\$0.07	\$0.32
1974	\$0.40	\$0.16	\$0.13	\$0.32
1975	\$0.40	\$0.16	\$0.13	\$0.24
1976	\$0.50	\$0.32	\$0.17	\$0.30
1977	\$0.65	\$0.40	\$0.16	\$0.30
1978	\$0.65	\$0.35	\$0.20	\$0.30
1979	\$0.88	\$0.66	\$0.16	\$0.41
1980	\$0.74	\$0.63	\$0.07	\$0.23
1981	\$1.25	\$0.62	\$0.13	\$0.26
1982	\$1.25	\$0.57	\$0.12	\$0.32
1983	\$1.13	\$0.39	\$0.11	\$0.28
1984	\$1.20	\$0.45	\$0.11	\$0.24
1985	\$1.08	\$0.48	\$0.20	\$0.31
1986	\$0.88	\$0.52	\$0.15	\$0.27
1987	\$1.11	\$0.57	\$0.20	\$0.33
1988	\$1.26	\$1.13	\$0.19	\$0.39
1989	\$0.73	\$0.43	\$0.10	\$0.18
1990	\$1.01	\$0.50	\$0.75 ^a	\$0.23
1991 ^b	\$0.87	\$0.36	-	\$0.27
1992 ^c	\$0.66	\$0.33	\$0.16	\$0.22
1993 ^d	\$0.72	\$0.22	\$0.15	\$0.24
1994	\$1.02	\$0.52	\$0.15	\$0.29

^a Price paid per pound of roe.

^b Price paid for coho and chum roe was \$3.00 per pound.

^c Price paid for coho roe was \$1.50 per pound.

^d Price paid for coho roe was \$1.76 per pound and \$0.40 per pound for sockeye.

Appendix Table A13. Comparative salmon escapement indices of Norton Sound streams, 1961-1994.

Year	Chinook	Chum	Pink	Pink & Chum	Coho
Sinuk River					
1975	-	4,662	5,390	-	-
1977	-	5,207	1,302	-	-
1978	-	8,756	22,435	-	-
1980	3	2,022	199,000	-	1,002
1981	-	5,579	350	-	-
1982	-	638	148,800	-	-
1983	48	2,150	10,770	-	96
1984	7	493	284,400	-	192
1985	4	1,910	8,860	-	33
1986	4	1,960	28,690	-	-
1987	5	4,540	30	-	230
1988	3	2,070	4,652	-	563
1989	-	1,025	26,850	-	75
1990	-	95	29,040	-	161
1991	3	5,420	14,680	-	701
1992	-	470	292,400	-	422
1993	7	1,570	5,120	-	104
1994	10	1,140	492,000	-	307
Nome River					
1971	-	75	7,765	-	-
1972	-	710	14,960	-	-
1973	6	1,760	14,940	-	-
1974	-	854	17,832	-	-
1975	1	2,161	3,405	-	-
1977	5	3,046	1,726	-	-
1978	2	5,242	34,900	-	-
1980	5	-	-	179,095	920
1981	15	1,195	12,565	-	-
1982	-	700	327,570	-	-
1983	2	198	9,170	-	365
1984	-	2,084	178,870	-	839
1985	7	1,967	2,250	-	242
1986	2	1,150	13,580	-	-
1987	3	1,646	1,400	-	419
1988	3	973	2,490	-	1,280
1989	2	72	1,365	-	375
1990	-	541	13,085	-	617
1991	9	3,520	4,690	-	611
1992	3	813	255,700	-	691
1993	56	1,520	9,212	-	3,061
1994	41	2,974	141,116	-	1,263
Flambeau River					
1976	-	375	1,994	-	-
1977	-	1,275	10	-	-
1978	-	7,110	-	-	-
1979	-	283	291	-	-
1980	-	-	-	29,190	-
1981	1	12,031	2,710	-	-
1982	1	5,097	25,001	-	-
1983	2	1,195	200	-	-
1984	1	3,150	20,200	-	-
1985	1	3,215	260	-	-
1986	2	3,075	300	-	-
1987	0	115	0	-	-
1988	3	765	10	-	-
1989	-	-	-	-	-
1990	-	-	-	-	-
1991	2	1,564	570	-	-
1992	-	606	180	-	-
1993	-	1,590	-	-	-
1994	1	4,960	290	-	-

-Continued-

Appendix Table A13. (page 2 of 5)

Year	Chinook	Chum	Pink	Pink & Chum	Coho
Eldorado River					
1974	13	2,143	6,185	-	-
1977	-	1,835	125	-	-
1978	-	10,125	12,800	-	-
1980	6	9,900	55,520	-	-
1981	-	15,605	495	-	-
1982	2	1,095	163,300	-	-
1983	11	994	270	-	100
1984	14	4,361	1,924,935	-	261
1985	8	6,090	150	-	67
1986	9	3,490	18,200	-	-
1987	6	3,860	0	-	108
1988	17	2,645	1,045	-	78
1989	-	350	1,550	-	87
1990	17	884	2,050	-	44
1991	76	5,755	1,590	-	98
1992	-	4,887	6,615	-	113
1993	38	2,885	120	-	110
1994	2	5,140	53,890	-	242
Fish River					
1961	1	-	-	14,100	-
1962	48	-	-	28,918	-
1963	21	-	-	25,728	-
1964	-	18,670	10,935	14,550	-
1966	7	-	-	17,955	-
1967	20	-	-	13,610	-
1968	10	-	-	164,000	-
1969	-	2,080	124,000	-	-
1970	33	76,550	198,000	-	-
1971	1	13,185	1,670	-	-
1972	-	3,616	13,050	-	-
1973	31	6,887	15,564	-	-
1974	7	10,945	15,690	-	-
1975	26	20,114	15,840	-	-
1976	1	8,390	15,850	8,550	-
1977	9	9,664	2,430	-	-
1978	29	26,797	140,640	-	-
1979	11	6,893	9,132	-	-
1980	-	19,100	33,500	-	-
1981	90	24,095	450	-	-
1982	-	-	-	241,700	-
1983	87	20,037	300	-	-
1984	42	-	-	293,245	-
1985	303	21,080	7,365	-	-
1986	200	25,190	140	-	-
1987	193	7,886	0	-	-
1988	36	1,240	29,950	-	-
1989	-	-	-	-	-
1990	-	-	-	-	-
1991	58	10,190	51,190	-	-
1992	4	390	1,387,000	-	-
1993	48	12,695	13,440	-	-
1994	55	16,500	910,000	-	-
Kachavik Creek					
1963	-	16,000	16,000	-	-
1964	-	5,284	3,675	-	-
1966	-	758	1,788	-	-
1967	-	-	-	1,780	-
1969	-	600	4,525	-	-
1970	-	500	-	-	-
1971	-	1,000	5,323	-	-
1972	-	3,100	16,950	-	-
1973	-	10,325	22,275	-	-
1974	-	1,645	2,723	-	-
1975	-	1,735	23,360	-	-
1977	-	9,564	30,432	-	-
1978	-	3,481	26,533	-	-
1979	-	2,650	23,850	-	-
1982	-	1,111	72,235	-	-
1986	-	1,440	3,130	-	-

-Continued-

Year	Chinook	Chum	Pink	Pink & Chum	Coho
Boston Creek					
1963	67	1,669	-	-	-
1964	10	3,315	-	-	-
1966	153	761	-	-	-
1968	7	2,500	2,500	-	-
1969	100	7,000	16,000	-	-
1970	246	8,200	12,900	-	-
1971	42	7,045	80	-	-
1972	57	4,252	3,950	-	-
1973	153	3,014	3,213	-	-
1974	231	2,426	749	-	-
1975	147	1,885	2,556	-	-
1977	76	1,325	385	-	-
1978	136	2,655	74,221	-	-
1979	58	882	271	-	-
1980	16	2,450	1,510	-	-
1982	10	1,730	22,020	-	-
1983	154	704	-	-	-
1984	35	-	-	47,850	-
1985	243	3,450	-	-	-
1986	2	220	0	-	-
1987	583	3,640	0	-	-
1988	163	1,040	7,400	-	-
1989	-	-	-	-	-
1990	-	1,455	8,440	-	-
1991	152	2,550	3,210	-	-
1992	68	1,540	803,200	-	-
1993	227	4,513	1,930	-	-
1994	95	4,270	355,600	-	-
Niukluk River					
1962	11	-	-	27,879	-
1963	1	13,687	4,103	-	-
1964	-	8,395	10,495	-	-
1966	-	21,300	8,600	4,700	-
1967	-	20,546	-	-	-
1968	-	-	-	87,085	-
1969	-	10,240	92,650	-	-
1970	-	7,300	60,350	-	-
1971	-	22,605	8,370	-	-
1972	-	10,500	22,600	-	-
1973	-	14,365	14,790	-	-
1974	1	8,720	8,915	-	-
1975	-	10,089	16,258	-	-
1976	-	4,130	7,190	-	-
1977	19	10,456	4,150	-	-
1978	2	14,365	208,300	-	-
1979	8	10,127	30,147	-	-
1980	-	8,915	75,770	-	-
1981	-	7,249	-	-	-
1982	20	2,557	227,540	-	-
1983	54	8,886	50	-	-
1984	6	-	-	57,208	3,072
1985	25	11,140	-	-	332
1986	2	2,442	0	-	-
1987	10	4,145	0	-	257
1988	18	6,501	8,160	-	1,095
1989	-	-	-	-	162
1990	-	6,200	-	-	170
1991	24	10,660	37,410	-	1,783
1992	-	7,770	803,200	-	812
1993	15	19,910	2,840	-	2,104
1994	7	16,470	1,294,100	-	274

-Continued-

PORT CLARENCE DISTRICT

District Boundaries

The Port Clarence district encompasses all waters from Cape Douglas north to Cape Prince of Wales including the Salmon Lake and Pilgrim River drainage (Figure 2). Salmon, saffron cod, whitefish and herring are the major subsistence species; however, other fishery resources are also utilized.

Commercial Fishery

Commercial salmon fishing in this district has been prohibited since 1967. In 1966 a total of 1,216 salmon consisting of 93 sockeye, 131 pinks and 922 chums was taken commercially in the Grantley Harbor/Tuksuk Channel area. A few salmon are sold or bartered each year in Teller and Nome. Due to the relatively small runs in this area and the existence of an important subsistence fishery, commercial salmon fishing has not been reopened.

Subsistence Fishery

A traditional subsistence salmon fishery has probably occurred within this district for centuries; however, subsistence fishing has only been reported or monitored at Salmon Lake since the 1930's and upper Pilgrim River since 1962. Data collected by Department personnel has indicated a majority of the fishermen of Brevig Mission fish the northern and northeastern sections of Port Clarence, while Teller fishermen utilize Grantley Harbor and Tuksuk Channel. Interviews with local residents have also indicated substantial fishing effort within the Agiapuk River. Village surveys have not been conducted by Commercial Fisheries Division since 1983. Subsistence Division conducted a partial survey of Brevig Mission in 1989 where 15 of 43 households were interviewed (Appendix Table B1). Personal interviews with fishermen seem to indicate a decline in subsistence fishing effort, due primarily to the absence of younger fishermen entering the fishery. A majority of the subsistence fishing effort appears to be conducted by elder residents who gather fish for an entire family.

Salmon Lake and Pilgrim River stocks have been utilized primarily by Nome residents. The Alaska Board of Fisheries adopted a regulation in 1972 which closed Salmon Lake and its tributaries to subsistence salmon fishing from July 15 through August 31 to conserve declining sockeye salmon stocks. Subsistence fishing permits are required for the Pilgrim and Kuzitrin Rivers. Beginning in the 1991 season, a dramatic increase in the number of subsistence permits issued to Nome residents intending to fish in the area was observed (Table 2). This was due in part due to a strong sockeye salmon return. Another reason was the extensive subsistence fishing closures in the Nome area which made the Pilgrim River an alternative location to obtain their subsistence needs.

Escapement

Aerial surveys were not flown in this district, with the exception of Salmon Lake, due to the low priority assigned to districts which do not support commercial fisheries. Aerial surveys show an increasing trend of sockeye returns to Salmon Lake since 1986 (Appendix Table B2). The 1994 aerial survey count of 4,960 red salmon is the highest on record since 1963. Recent year counts are in the upper end of the range and reflect an increasing populations.

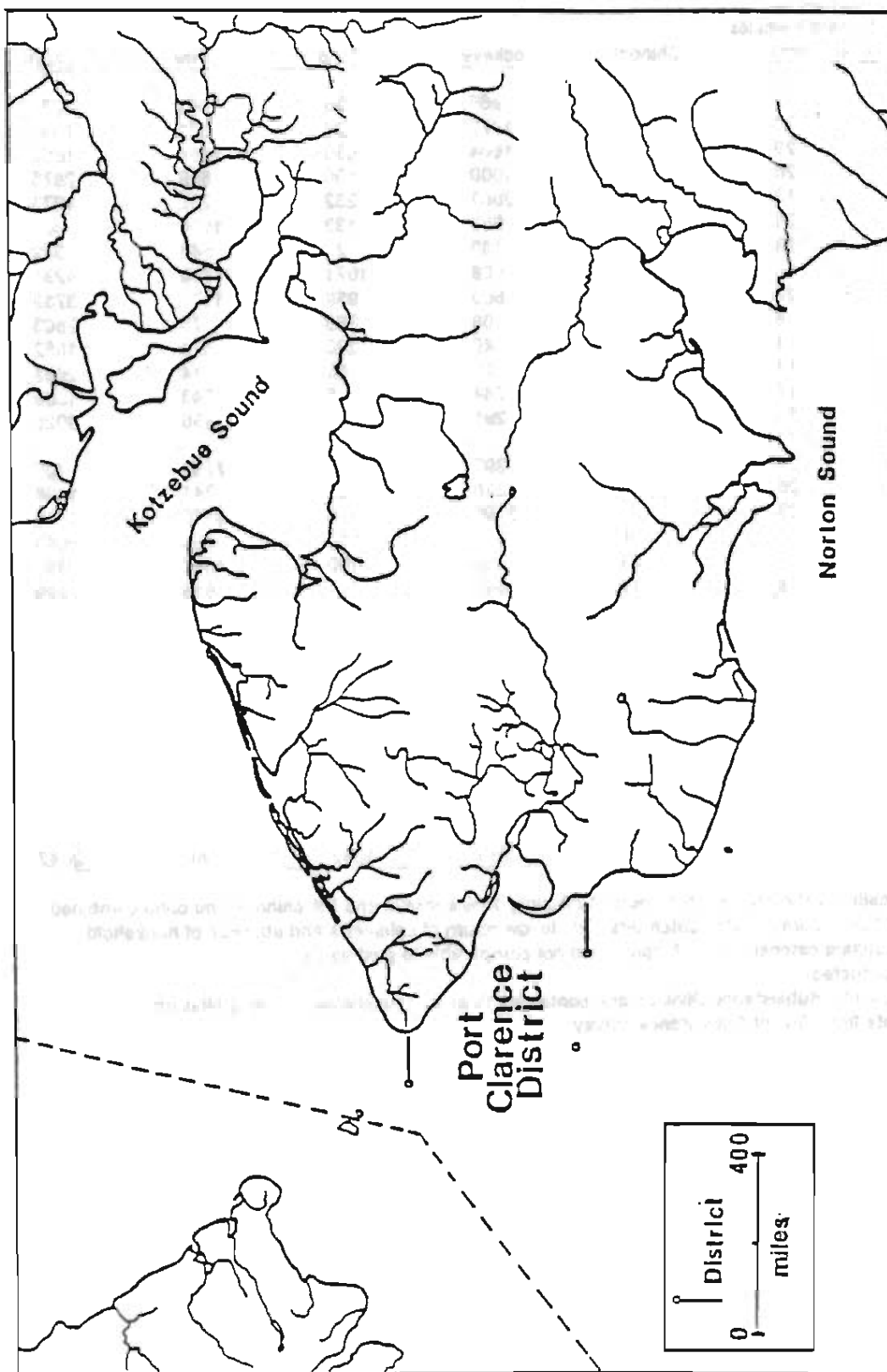


Figure 2. Port Clarence district

Year	Number of Fishing Families Interviewed	Chinook	Sockeye	Coho	Pink	Chum	Total
1963	19	9	4866	25	1061	1279	7240
1964	22	17	1475	227	371	1049	3139
1965	29	36	1804	639	1854	1602	5935
1966	26	10	1000	896	859	2875	5640
1967	19	12	2068	232	767	1073	4152
1968	24	40	688	133	1906	904	3671
1969	13	2	180	27	548	932	1689
1970	18	4	588	1071	1308	4231	7202
1971	22	31	850	959	1171	3769	6780
1972	8	4	68	388	75	2806	3341
1973	4	22	46	280	424	1562	2334
1974	13	0	28	62	14	2663	2767
1975	17	0	244	5	743	1589	2581
1976	15	7	291	20	436	6026	6780
1977 ^a	13	-	-	-	-	-	5910
1978	26	1	392	0	7783	705	8881
1979	26	0	320	35	741	1658	2754
1980	22	7	3195	5	3170	1715	8092
1981	10	8	255	110	765	5845	6983
1982	27	23	405	100	4345	684	5557
1983 ^b	3	17	261	-	615	299	1192
1984 ^c							
1985 ^c							
1986 ^c							
1987 ^c							
1988 ^c							
1989 ^d	15	28	535	472	395	410	1840
1990 ^c							
1991 ^c							
1992 ^c							
1993 ^c							
1994 ^e	127	181	1979	1692	3849	2042	9743

^a Species composition estimated at 75% chum, 10% pink, 10% sockeye and 5% chinook and coho combined.

^b Data collected from returned catch calendars. Due to low return of calendars and absence of household surveys, the resultant catches are incomplete and not comparable to past years.

^c Surveys not conducted.

^d Survey conducted by Subsistence Division and contacted 15 of 43 households in Brevig Mission.

^e Harvest estimate from Div. of Subsistence survey.

Appendix Table B2. Comparative sockeye salmon aerial survey indices, Port Clarence District, 1963-1994.

Year	Salmon	Grand Central	Total
	Lake	River	
1963	866	620	1486
1964 ^c	76	590	666
1965	250	160	410
1966	1120	370	1490
1967	129	280	409
1968 ^c	830	645	1475
1969	24	171	195
1970 ^a	-	-	-
1971	538	512	1050
1972 ^c	680	300 ^b	980
1973	1747	607	2354
1974	820	0	820
1975	537	123	660
1976	132	22	154
1977	317	235	552
1978	822	280	1102
1979	1250	261	1511
1980 ^c	512	175	687
1983	970	-	970
1984	445	30	475
1985	730	250	980
1986	2125	160	2285
1987	4040	530	4570
1988	1195	6	1201
1989	3055	525	3591
1990	2834	926	3760
1991	3790	1570	5360
1992	1500	^a	1500
1993	2885	216	3092
1994	3740	1230	4970

^a No survey made.

^b Boat survey.

^c Poor survey.

KOTZEBUE SOUND

History

The Kotzebue District supports the northernmost commercial salmon fishery in Alaska (Figure 3). The recent commercial fishery opened under state management in 1962. Salmon harvests consist primarily of chum salmon, although a few chinook salmon and Dolly Varden are incidentally harvested. There are 218 commercial permit holders, of which an average of 163 were active over the recent 10 year period (1984-1993). Eighty-seven percent are residents of the district and 97 percent are state residents.

The earliest sales of salmon in the Kotzebue District were in 1909 when Lockhart's store handled 21,906 pounds of salmon purchased from eskimos and was resold at \$.05/lb. Of this, 21,366 lbs. were sold to gold miners in the Kobuk River drainage and 540 lbs. were sold to a company in Seattle. A commercial fishery occurred between 1914-1918 when salmon were canned and the bulk of it was also thought to have been sold to miners working in the Upper Kobuk. After state management in 1962, the fishery became fully developed during the mid-70's. Since that time, the fishery has displayed a cyclic pattern of harvest with alternating and declining strong and weak returns over four year intervals (Appendix Table C.1., Figure 5). In 1987, the Department began a rebuilding program with an emphasis on attaining escapement goals. Prior to 1987, commercial harvests were more in proportion to the annual chum return. Current fisheries management is based on a comparison of age composition and catch rate in the commercial fishery to the historic fisheries harvest statistics compiled since 1978. The department is presently also utilizing sonar passage estimates for the Noatak River obtained during the latter third of the season when Noatak stocks predominant the return.

General Information

The Commercial harvest in the Kotzebue district (Figure 1, Figure 2) during 1994 consisted of 149,452 chum salmon, 4 chinook salmon, and 149 Dolly Varden (Table 1). This commercial chum harvest was near the upper projected range of 75,000-150,000 salmon. This catch was roughly half of the 15 year (1979-1993) average of 291,000. There were 109 permits that fished this year. This is the lowest amount of participants since 1972 (104). The low fishing effort is attributed largely to construction opportunities available in the region and the lowest salmon prices since 1972 (\$0.20).

Gear is limited to set nets with a aggregate of no more than 150 fathoms per fisherman. Fishermen generally operate with one end on or near shore and with all three shackles connected. Fishermen also set in deeper channels in the mud flats further out from shore. Most gear used in the district is 5-7/8 in (14.9 cm) or 6 in (15.2 cm) stretch multifilament gill net.

From July 11 to July 29 the season began normally with bi-weekly fishing periods. After period 6 when buyers could not purchase what was caught buyers met with the department managers. Buyers explained that because of the salmon glut on the market they were held to purchasing a limited poundage for each commercial period. For the remainder of the season, openings were coordinated with buyers so that fish in excess of their limitations would not be taken and could be shipped out for processing in a timely manner. A total of twenty-one openings were fished in 1994 for a total of 236 hours. Since the fishery's inception in 1962, only 1993 (168) had fewer hours fished. This was about half of the recent 15 year (1979-1993) average (456). Commercial fishing period lengths varied from 3 hours to 36 hours in length during the 1994 season.

During 1994, four buyers purchased a total of 1,166,494 pounds of chum salmon (average weight 7.8) at \$.20 per pound, 73 pounds of chinook salmon (average weight 18.3) at an average of \$1.14 per pound, and 767 pounds of Dolly Varden (average weight 5.1) at an average of \$.17 per pound. The total ex-vessel value was \$233,512 to Kotzebue area fishermen with an average of \$2,319 for each participating permit holder (Table 2). All buyers packed their fish in ice and flew them out in the round for processing. Three buyers flew fish to Anchorage, one buyer flew fish to Bethel or to Anchorage then on to Kenai for processing. In addition, 4,000 chum salmon at an estimated 31,500 pounds were delivered but not sold.

Inseason Management

Primary fishery management objectives were to provide adequate chum salmon escapement through the commercial fishery: (1) to ensure sustained runs by allowing adequate natural escapement, and (2) to meet subsistence harvest needs. Fishery management depended on comparing period and cumulative season catch rates to that of previous years during the early part of the season and the Noatak River cumulative sonar counts during the last 6 periods. A comparison of catch rates over the history of the fishery has shown a close relationship may exist to the total run strength.

Age composition of catches were also closely monitored to determine the strength of age classes in the return. Older salmon tend to migrate into freshwater first; a fact that affects catch rate as the season progresses and affects the fishery managers evaluation of the catch statistics. Weak 3 and 4 year old age classes will tend to depress mid season catches.

Meetings were held with fishermen throughout the season to distribute information, gain input from local fishermen, and to announce future management strategies. Contact with the Kobuk River subsistence fishermen was maintained. A test fishery occurred for the second year on the Kobuk River however test fish indices were not used for management purposes because of the lack of historical data. Information from the Kobuk River test fishery will be available in report form on a later date.

Commercial Season Summary

The Kotzebue Sound commercial salmon season was opened July 11 by emergency order as established by regulation. Commercial catch for the first 3 periods mirrored the recent 15 year average. However, catch-per-unit-effort (CPUE) was above average during this time (Table 3, Figure 3). Catch and catch rates for the first 3 periods indicated the chum salmon run to be at least average. With this information, average fishing time was warranted therefore Periods 4 and 5 were 24 hours in length.

Just before the commercial opening for Period 5, Monday, July 25, the City of Kotzebue delivered letters ordering three of the four buyers to cease operations because they did not have tide land use permits required by the city. The sole buyer had reached his poundage limit Tuesday afternoon, several hours before the period closure. The City Manager was due to arrive from Anchorage at 5:30 that afternoon at which time an emergency meeting of the city council was held. Permits for the three buyers were hastily processed and approved. The orders to cease operations affected all three buyers in different manners. One buyer felt it would not be feasible to begin purchasing fish at the period closure. A second buyer, because he could not deliver fish as expected, lost his original market and was unable to purchase fish. The third, opened for business literally at the time of the closure and was able to purchase the remaining fish.

Catch rates for periods 4 and 5 were above average and catches were near average. Age composition indicated an expected weaker than normal age-5 fish but a stronger than expected age-4 fish, (Table 5, Figure 4). Normally at this time half the fish are 4-year-olds. Age composition for age-4 was 68% for periods 4 and 5. With a continued average salmon run, fishing time for Periods 6 and 7 was extended to 36 hours in length.

Period 6 changed the management strategy for the rest of the season. The period began at 6:00 a.m. Thursday morning with three of the four buyers purchasing fish. At 5:00 a.m. one buyer called the area manager and stated that he and another buyer selling to the same processor were very near their purchase limits and questioned if the remaining buyer could handle the remaining fish. Throughout Friday morning and afternoon, the remaining buyer stated to several department personnel that they could and would purchase all of the fish during the remainder of the period. However, on Saturday morning an estimated 65,000 pounds of chum salmon were sitting in totes on the beach. Of those, it is estimated that 31,500 pounds were unloaded from fishermen but not purchased. The rest were purchased but not shipped. No fish were wasted as fish on ice were used by the community for human consumption and those not on ice were distributed to dog mushers for dog food.

A meeting between buyers and department personnel was held that afternoon. Three of the four buyers attended. Those buyers stated again that they were restricted to purchasing a limited poundage. It was agreed that the buyers would contact local managers in the morning on a daily basis and let us know what poundage they could purchase on specific days. Fishing time was adjusted so that the quantity of fish harvested remained below the processor's quota. The remainder of the season was managed in this manner; Noatak River sonar counts remaining at

a level at which the escapement goal should be made. The staff felt that the escapement would not be a factor and that commercial fishing should continue. Buyers also held a meeting with fishermen explaining that because of the market and the cost of flying fish out, the best price that they could offer was \$.15/lb. Buyers asked fishermen if they would fish for that amount and those who attended said they would. However, with the reduced hours requested by the buyers, a large number of fishermen felt it was not worth their time and quit fishing.

One of the three buyers ceased operations on August 3 leaving an even more limited market. The second buyer's last day of purchasing fish was August 17. The remaining buyer purchased fish through August 24 before closing. Under a normal fishing schedule, two more commercial periods would have occurred. Because of a lack of commercial samples during periods without a buyer, the department contracted local fishermen to test fish for age composition.

During the latter portion of the fishery, an interesting discovery occurred concerning the migration pattern of hatchery and wild stock chum salmon passing through the fishery. During Periods 17, 19, 20 and 21 the commercial harvest of salmon was nearly all hatchery fish. Period 18 however was entirely wild stock. Period 18 occurred under unfavorable weather conditions and all but one of the ten fishermen fished on the south side of the fishing district. Quite the opposite was true for Periods 17, 19, 20 and 21 when virtually the entire harvest was from the north side of the fishing district. This indicates that there could be separation between hatchery and wild stock salmon as they pass through the district (Table 4).

Age-5 salmon tend to dominate the earlier commercial openings with the younger age classes moving through during the latter part of the fishery. This was also true for 1994. A higher than average number of age-4 fish were found compared to historical averages. This probably reflects a weak 5-year-old age class coming off of a weak 1993 4-year-old age class. Age-3 salmon were normal during the first half of the season but declined to roughly half of average in the latter portion of the season (Table 6).

Sikusilaaq Hatchery Stock

An expected excess of hatchery stock prompted local buyers to again explore the possibilities of a salmon roe harvest. The Northwest Arctic Borough developed and sent out bids to prospective buyers. All buyers declined to bid for the excess salmon. The only most promising buyer said that his primary market did not want the eggs because of the excess chum salmon on the market and the other possible market would have had only produced marginal profits. Therefore, no commercial harvest of excess salmon at the hatchery occurred.

Escapement

Because of poor weather conditions and flooding conditions, no aerial surveys were flown during the entire season. A sonar project located on the Noatak River monitored escapements into that

drainage. A test fish project in it's second year, located in Kiana, monitored salmon run strength and timing into the Kobuk River. They also visited with subsistence fishermen to monitor subsistence catches at Kiana.

The chum salmon run into Kobuk River was quite strong based on test indices (Table 7, Figure 5). The test fish indices were more than twice that of 1993 when escapements were assessed to be barely adequate based on aerial survey indices for that year. Another indication that the Kobuk stock was strong is that the catch rates for Periods 3-6 were 1.5 to 2 times the average. One of the reasons for the high CPUE rates was there were fewer fishermen. Age-4 fish were also strong early in the season. Tributary Age/Sex/Length sampling also found larger quantities of carcasses than in the past. The chum salmon run into the Kobuk River was at minimum adequate.

This was the first year the entire Noatak River channel cross-section was enumerated by sonar. In past years only the "right" bank, when facing down river, was counted. Counts on the left bank were roughly 8-12 percent throughout the season so managers could deduct this from the entire count for comparison to past years. For the first time a specific goal of 160,000 chum salmon for the wild stock total passage was established. This goal was calculated using three previous tagging studies to separate Noatak and Kobuk River chum salmon stocks in Kotzebue Sound.

The Noatak River sonar began counting on July 22. Within one week, comparable counts on the right bank were three times that of 1993 (Table 8, Figure 6). The sonar passage remained twice that of 1993 until mid-August. When expanded out, had this passage rate continued, it would have produced a total passage of 180,000 to 200,000 chum salmon. However, towards the end of August passage rates slowed. The Noatak River sonar had counted a strong pulse of fish at the end of the season during 1993. A similar trend was expected to occur in 1994 because in previous years, subsistence catches have also indicated a similar pulse. During 1994, this late season pulse did not occur and counts remained relatively flat from the end of August through the end of the sonar project which was shut down on September 10. Based on post-season assessment, the chum salmon run into the Noatak River was an early return. A total count past the sonar was 161,500 chum salmon. The Sikusilaq Hatchery estimated return was 45,000-50,000 during sonar operations. This would put the wild stock escapement into the Noatak River at about 111,500-116,500 chum salmon.

Weather

In Northwest Alaska the general weather pattern for July and August was rain. In Kotzebue, the average rainfall for July and August is 1.46" and 2.03" respectively. This year the rainfall for July was 3.07", twice normal and for August 4.70, more than twice the average. The rainfall for August in 1994 was only 0.48" short of the all time record of 5.18. The Sikusilaq Hatchery received half it's annual precipitation in a single weekend. The village of Kobuk reported the worst flood since 1937. This was corroborated with the Elders interviewed by the IRA in Kiana.

Most remembered a flood of this level when they were children. Some of them did not remember a flood this bad but did remember stories of a comparable flood from their parents. Watersheds in Northwest Alaska are quite large with a relatively low gradient. This results in river systems that take a substantial amount of time to drain. During carcass surveys, a tributary of the Kobuk River and the main stem of the Upper Kobuk showed that rivers were easily 5-7 feet above normal. Noatak River levels at the Sikusuilaq Hatchery were 8-10 feet above normal. These levels were above some spring breakup floods. In general, it was not until mid-September when the time rivers returned to normal levels.

Most salmon in the Kotzebue district tend to be more of a later spawning salmon. Because of this, managers feel that egg mortality did occur but survival of brood year stock should be good as most salmon return to the deep side channels that have flowing water throughout the winter. Egg survival would have been quite poor if the flood had occurred in September.

1995 Outlook

The outlook for the 1995 season is based on the returning age classes of the 1994 season. During the 1995 season, the four year old age component of the run is expected to be near average as is the five year old component. The three year old component is generally small, and it too is likely to be near average. The commercial harvest is expected to fall within the range from 250,000 to 350,000 chum salmon, assuming an adequate market.

Table 9. Commercial catches of chum salmon, chinook salmon, and Dolly Varden by period in the Kotzebue District, 1994.

Period	Date	Hours Fished	Number of Fishermen	Chum			Chinook			Dolly Varden		
				Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt.
1	July 11-12	24	18	1,529	12,009	7.9						
2	July 14-15	24	33	3,677	28,730	7.8						
3	July 18-19	24	40	12,887	98,368	7.6	1	14	14.0			
4	July 21-22	24	66	17,111	137,438	8.0	1	18	18.0			
5	July 25-26	24	69	14,530	116,404	8.0	1	21	21.0			
6	^a July 27-28	36	82	41,327	330,095	8.0	1	20	20.0			
7	August 1	6	38	2,957	23,231	7.9						
8	August 2	6	57	17,435	133,823	7.7						
9	August 4	3	51	7,110	55,828	7.9						
10	August 5	4	60	13,756	107,830	7.8						
11	August 9	3	25	1,644	12,153	7.4						
12	August 10	5	22	1,720	12,649	7.4						
13	August 12	3	35	5,303	40,095	7.6						
14	August 15	4	23	2,133	15,963	7.5						
15	August 16	4	21	2,826	20,580	7.3						
16	August 17	3	22	3,236	22,790	7.0						
17	August 18	4	18	1,758	12,209	6.9						
18	August 19	5	10	817	5,769	7.1						
19	August 22	9	10	682	4,828	7.1				79	416	5.3
20	August 23	9	5	473	3,310	7.0				8	56	7.0
21	August 24	12	7	541	3,892	7.2				62	295	4.8
Totals		236	109	153,452	1,197,994	7.8	4	73	18.3	149	767	5.1

^a 4,000 chum salmon and 31,500 lbs were added. These fish were commercially caught but not reported on fish tickets.

Table 10. Kotzebue District commercial chum salmon, chinook salmon, and Dolly Varden catch by statistical area, 1994.

Statistical Area	No. of Fishermen	Chum			Chinook			Dolly Varden		
		Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt.
331-01	96	82,810	642,007	7.8	3	53	17.7	2	10	5.0
331-02	49	34,604	268,770	7.8	1	20	20.0	147	757	5.1
331-03	9	2287	17377	7.6						
331-04	9	1,848	14,539	7.9						
331-05	21	14,467	116,471	8.1						
331-06	16	13,436	107,320	8.0						
Totals ^a	109	149,452	1,166,484	7.8	4	73	18.3	149	767	5.1

^a Does not include 4,000 chum salmon at 31,500 pounds taken commercially on July 29 but not reported on fish tickets.

Table 11. Kotzebue Sound chum salmon 1994 commercial and 15 year average catch statistics (1979-1993).

15 Year Average					Cumulative		
Period	Hours	Number Permits	Catch (x 1,000)	CPUE	Catch (x 1,000)	CPUE	Prop Catc
1	24	42	3.3	3.1	3.0	3.1	0.010
2	24	70	5.3	3.0	8.3	3.0	0.029
3	24	96	9.9	4.1	18.2	3.6	0.063
4	25	116	18.6	6.1	36.8	4.5	0.127
5	28	129	23.5	6.4	60.3	5.1	0.207
6	30	138	30.8	7.4	87.0	5.5	0.299
7	37	140	38.7	7.5	123.1	5.9	0.423
8	40	147	42.5	7.0	162.8	6.2	0.560
9	42	139	40.8	7.0	203.6	6.4	0.700
10	41	144	46.8	7.5	244.1	6.5	0.839
11	44	134	26.4	4.7	265.2	6.3	0.912
12	45	117	15.7	2.9	277.8	6.0	0.955
13	42	89	10.0	2.9	285.8	5.8	0.983
14	39	64	6.0	2.4	289.4	5.7	0.995
15	41	39	2.8	1.8	290.9	5.7	1.000

1994					Cumulative			
Period	Date ^a	Hours	Number Permits	Catch (x 1,000)	CPUE	Catch (x 1,000)	CPUE	Prop Catc
1	July 11-12	24	18	1.5	3.5	1.5	3.5	0.010
2	July 14-15	24	33	3.7	4.6	5.2	4.3	0.034
3	July 18-19	24	40	12.9	13.4	18.1	8.3	0.118
4	July 21-22	24	66	17.1	10.8	35.2	9.3	0.229
5	July 25-26	24	69	14.5	8.8	49.7	9.2	0.324
6	July 27-28	36	82	41.3	14.0	91.1	10.9	0.593
7	August 1-2	12	65	20.4	26.1	111.5	12.2	0.726
8	August 4-5	7	73	20.9	40.8	132.3	14.9	0.862
9	August 9-10	8	38	3.4	11.1	135.7	13.6	0.884
10	August 12	3	35	5.3	50.5	141.0	14.0	0.919
11	August 15-17	11	38	8.2	19.6	149.2	14.2	0.972
12	August 18-19	9	20	2.6	14.3	151.8	14.2	0.989
13	August 22-24	30	12	1.7	4.7	153.5	13.9	1.000
14	August 25	No commercial fishing due to lack of buyer.						
15	August 30	No commercial fishing due to lack of buyer.						

^a Commercial periods were combined so that comparisons from 1994 could be made to the historical average.

Table 12. Historical average age composition by period for the recent 15 years (1979-1993) and 1994.

15 Year Avg.		Percent				Catch by Age			
Period	Catch	3	4	5	6	3	4	5	6
1	3,260	0.4	33.5	61.9	4.3	13	1,091	2,017	140
2	5,288	1.0	41.5	53.5	3.9	53	2,195	2,829	206
3	9,914	1.4	39.2	53.5	5.8	139	3,888	5,306	576
4	18,603	1.4	47.7	47.5	3.4	260	8,874	8,836	633
5	23,464	1.4	45.8	48.0	4.8	328	10,747	11,263	1,126
6	30,790	1.8	53.0	42.6	2.6	554	16,319	13,117	801
7	38,697	2.9	55.0	40.0	2.0	1,122	21,283	15,479	774
8	42,480	4.7	59.9	33.5	1.9	1,997	25,446	14,231	807
9	40,828	6.7	56.7	34.0	2.6	2,735	23,149	13,882	1,062
10	46,756	6.3	62.7	29.8	1.3	2,946	29,316	13,933	608
11	26,415	12.6	62.9	23.4	1.0	3,328	16,615	6,181	264
12	15,668	13.5	57.2	27.1	2.2	2,115	8,962	4,246	345
13	10,028	14.7	64.6	19.3	1.5	1,474	6,478	1,935	150
14	5,991	11.4	62.3	25.4	0.8	683	3,732	1,522	48
15	2,783	4.8	67.5	26.6	1.1	134	1,879	740	31

Kotzebue Sound commercial catch and age composition, 1994.

1994		Percent					Catch by Age			
Period	Date	Catch	3	4	5	6	3	4	5	6
1	July 11-12	1,529	0.7	41.8	54.5	3.0	11	639	833	46
2	July 14-15	3,677	0.0	41.9	50.2	7.9	0	1,541	1,846	290
3	July 18-19	12,887	0.7	51.5	40.3	7.5	90	6,637	5,193	967
4	July 21-22	17,111	1.1	58.9	34.9	5.1	188	10,078	5,972	873
5	July 25-26	14,530	1.6	57.4	36.7	4.3	232	8,340	5,333	625
6	July 27-28	41,327	2.4	62.5	32.4	2.8	992	25,829	13,390	1,157
7	August 1-2	20,392	3.3	70.4	23.0	3.3	673	14,356	4,690	673
8	August 4-5	20,866	2.7	72.7	23.7	0.9	563	15,170	4,945	188
9	August 9-10	3,364	3.4	76.5	20.4	1.6	114	2,573	686	54
10	August 12	5,303	3.8	72.2	21.5	2.5	202	3,829	1,140	133
11	August 15-17	8,195	6.5	74.1	18.7	0.7	533	6,072	1,532	57
12	August 18-19	2,575	6.1	77.0	16.3	0.5	158	1,984	419	14
13	August 22-24	1,696	6.3	60.1	32.1	1.5	107	1,020	545	25
14	August 25		7.4	74.1	18.5	0.0	Age composition from commercial test samples.			
15	August 30		4.6	71.3	24.1	0.0	Age composition from commercial test samples.			

a. Commercial periods were combined so that comparisons from 1994 could be made to the historical average.

Table 13. Kobuk River drift test fish historical mean daily and cumulative CPUE and CPUE proportions, 1993-1994.

Date	CPUE				Proportions			
	1993		1994		1993		1994	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
10-Jul								
11-Jul								
12-Jul	11.18	11.18			0.023	0.023		
13-Jul	14.22	25.40	0.00	0.00	0.029	0.051	0.000	0.000
14-Jul	20.57	45.97	2.68	2.68	0.042	0.093	0.002	0.002
15-Jul	35.08	81.05	2.58	5.26	0.071	0.164	0.002	0.004
16-Jul	13.19	94.24	11.35	16.61	0.027	0.191	0.009	0.014
17-Jul	17.27	111.51		16.61	0.035	0.226		0.014
18-Jul		111.51	7.16	23.77		0.226	0.006	0.020
19-Jul	10.71	122.22	12.40	36.17	0.022	0.247	0.010	0.030
20-Jul	2.76	124.98	3.65	39.82	0.006	0.253	0.003	0.033
21-Jul	3.20	128.18	7.30	47.12	0.006	0.259	0.006	0.039
22-Jul	5.52	133.70	3.58	50.68	0.011	0.271	0.003	0.042
23-Jul	27.15	160.85	16.49	67.17	0.055	0.325	0.014	0.055
24-Jul	9.06	169.91		67.17	0.018	0.344		0.055
25-Jul		169.91	14.38	81.55		0.344	0.012	0.067
26-Jul	15.22	185.13	47.65	129.20	0.031	0.375	0.039	0.106
27-Jul	8.06	193.19	40.66	169.86	0.016	0.391	0.033	0.139
28-Jul	16.36	209.55	57.83	227.69	0.033	0.424	0.047	0.187
29-Jul	0.93	210.48	33.62	261.31	0.002	0.426	0.028	0.214
30-Jul	0.92	211.40	69.21	330.52	0.002	0.428	0.057	0.271
31-Jul	12.58	223.98		330.52	0.025	0.453		0.271
01-Aug		223.98	82.16	412.68		0.453	0.067	0.339
02-Aug	6.74	230.72	65.12	477.80	0.014	0.467	0.053	0.392
03-Aug	54.49	285.21	71.79	549.59	0.110	0.577	0.059	0.451
04-Aug	44.23	329.44	108.98	658.57	0.090	0.667	0.089	0.540
05-Aug	89.30	418.74	59.74	718.31	0.181	0.847	0.049	0.589
06-Aug	18.60	437.34	102.56	820.87	0.038	0.885	0.084	0.673
07-Aug	20.52	457.86		820.87	0.042	0.927		0.673
08-Aug		457.86	62.75	883.62		0.927	0.051	0.725
09-Aug	1.84	459.70	96.86	980.48	0.004	0.930	0.079	0.804
10-Aug	12.63	472.33	45.83	1,026.31	0.026	0.956	0.038	0.842
11-Aug	18.11	490.44	57.02	1,083.33	0.037	0.992	0.047	0.889
12-Aug	3.74	494.18	90.54	1,173.87	0.008	1.000	0.074	0.963
13-Aug			11.36	1,185.23			0.009	0.972
14-Aug				1,185.23				0.972
15-Aug			5.13	1,190.36			0.004	0.977
16-Aug			16.23	1,206.59			0.013	0.990
17-Aug			0.00	1,206.59			0.000	0.990
18-Aug			0.00	1,206.59			0.000	0.990
19-Aug			3.12	1,209.71			0.003	0.992
20-Aug			0.00	1,209.71			0.000	0.992
21-Aug				1,209.71				0.992
22-Aug			0.00	1,209.71			0.000	0.992
23-Aug			0.00	1,209.71			0.000	0.992
24-Aug			0.00	1,209.71			0.000	0.992
25-Aug			0.91	1,210.62			0.001	0.993
26-Aug			5.56	1,216.18			0.005	0.998
27-Aug			1.86	1,218.04			0.002	0.999
28-Aug			0.93	1,218.97			0.001	1.000
29-Aug			0.00	1,218.97			0.000	1.000
30-Aug			0.00	1,218.97			0.000	1.000

• Regular days off.

Table 14. Noatak River Sonar daily and cumulative chum salmon counts, 1990-1994.

Date	1990		1991		1992		1993		1994	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
10-Jul			412	412						
11-Jul			275	687						
12-Jul			264	951						
13-Jul			289	1,239						
14-Jul			490	1,729						
15-Jul			785	2,514						
16-Jul			683	3,198						
17-Jul			133	3,330						
18-Jul			118	3,448			290	290		
19-Jul			82	3,531			372	662		
20-Jul	439	439	176	3,707			214	876		
21-Jul	861	1,301	170	3,876			29	905		
22-Jul	567	1,867	231	4,107			32	937	133	133
23-Jul	509	2,396	292	4,399			26	963	463	596
24-Jul	980	3,376	246	4,645			96	1,059	1,345	1,941
25-Jul	615	3,991	543	5,188			159	1,218	945	2,886
26-Jul	602	4,593	570	5,758			386	1,604	1,552	4,438
27-Jul	587	5,180	850	6,608	1,795	1,795	356	1,959	2,208	6,646
28-Jul	2,469	7,649	707	7,314	860	2,655	977	2,937	5,755	12,401
29-Jul	1,432	9,081	1,038	8,353	253	2,908	548	3,485	5,882	18,283
30-Jul	756	9,837	1,419	9,772	355	3,263	722	4,207	3,846	22,109
31-Jul	1,174	11,011	678	10,450	351	3,614	582	4,789	4,343	26,452
01-Aug	626	11,637	1,292	11,742	710	4,324	506	5,296	3,010	29,462
02-Aug	390	12,027	1,464	13,205	1,482	5,806	1034	6,330	3,211	32,673
03-Aug	647	12,674	1,917	15,123	485	6,291	1283	7,613	2,002	34,675
04-Aug	445	13,119	5,009	20,132	282	6,573	2420	10,033	5,238	39,913
05-Aug	941	14,060	2,746	22,878	1,499	8,072	3587	13,620	7,994	47,907
06-Aug	1,076	15,135	2,087	24,966	1,835	9,907	6115	19,734	6,905	54,812
07-Aug	1,903	17,039	2,002	26,968	1,161	11,068	2997	22,732	7,785	62,597
08-Aug	1,366	18,404	1,563	28,531	3,837	14,905	4353	27,085	9,049	71,646
09-Aug	1,594	19,998	890	29,420	1,305	16,210	5106	32,190	7,557	79,203
10-Aug	2,086	22,084	744	30,164	1,205	17,415	6585	38,775	4,870	84,073
11-Aug	1,983	24,067	1,839	32,003	3,142	20,557	5569	44,344	3,836	87,911
12-Aug	2,067	26,134	2,346	34,350	1,474	22,031	3994	48,338	811	88,722
13-Aug	2,343	28,477	2,837	37,187	1,763	23,794	4302	52,640	774	89,496
14-Aug	1,982	30,460	6,264	43,451	548	24,342	2713	55,353	5,536	95,032
15-Aug	757	31,217	7,087	50,537	1,475	25,817	1827	57,179	5,885	100,917
16-Aug	810	32,026	5,963	56,500	4,667	30,484	1686	58,865	5,970	106,887
17-Aug	1,626	33,653	2,852	59,352	4,986	35,470	1545	60,410	3,568	110,455
18-Aug	1,770	35,422	2,237	61,589	2,804	38,274	1702	62,112	2,984	113,439
19-Aug	1,270	36,692	2,291	63,879	3,652	41,926	1520	63,632	2,984	116,423
20-Aug	886	37,578	3,068	66,948	4,873	46,799	4708	68,340	2,984	119,407
21-Aug	468	38,046	1,928	68,876	4,444	51,243	7980	76,320	2,984	122,391
22-Aug	635	38,681	2,215	71,091	1,429	52,672	3417	79,738	2,984	125,375
23-Aug	644	39,325	1,933	73,025	1,080	53,752	2970	82,708	2,399	127,774
24-Aug	535	39,860	1,410	74,435	2,561	56,313	2526	85,234	5,357	133,131
25-Aug	993	40,853	1,320	75,755	2,204	58,517	2613	87,847	7,642	140,773
26-Aug	1,078	41,931	1,464	77,219	3,724	62,241	2467	90,314	5,007	145,780
27-Aug			1,747	78,966	5,077	67,318	2232	92,546	2,867	148,647
28-Aug			1,385	80,351	1,428	68,746	2646	95,192	1,430	150,077
29-Aug			1,147	81,498	1,319	70,065	1988	97,180	616	150,693
30-Aug			1,241	82,739			1778	98,958	606	151,299
31-Aug							2492	101,449	1,005	152,304
01-Sep							1922	103,371	891	153,295
02-Sep							1624	104,995	1,312	154,607
03-Sep							1531	106,526	1,349	155,956
04-Sep							955	107,481	1,124	157,080
05-Sep							1338	108,818	1,167	158,247
06-Sep							891	109,709	1,245	159,492
07-Sep							2965	112,674	538	160,030
08-Sep							2455	115,129	532	160,562
09-Sep							1667	116,796	464	161,026
10-Sep							232	117,029	462	161,488
11-Sep							125	117,153		
12-Sep							251	117,405		
13-Sep							582	117,986		

• Transducer used in counting was 420 kHz on right bank only.

• Transducer used in counting was 120 kHz on right bank only.

• Transducers used in counting were 120 kHz on left and right bank for a total passage count. Sonar was pulled out because of high water and counts from August 18-22 were interpreted.

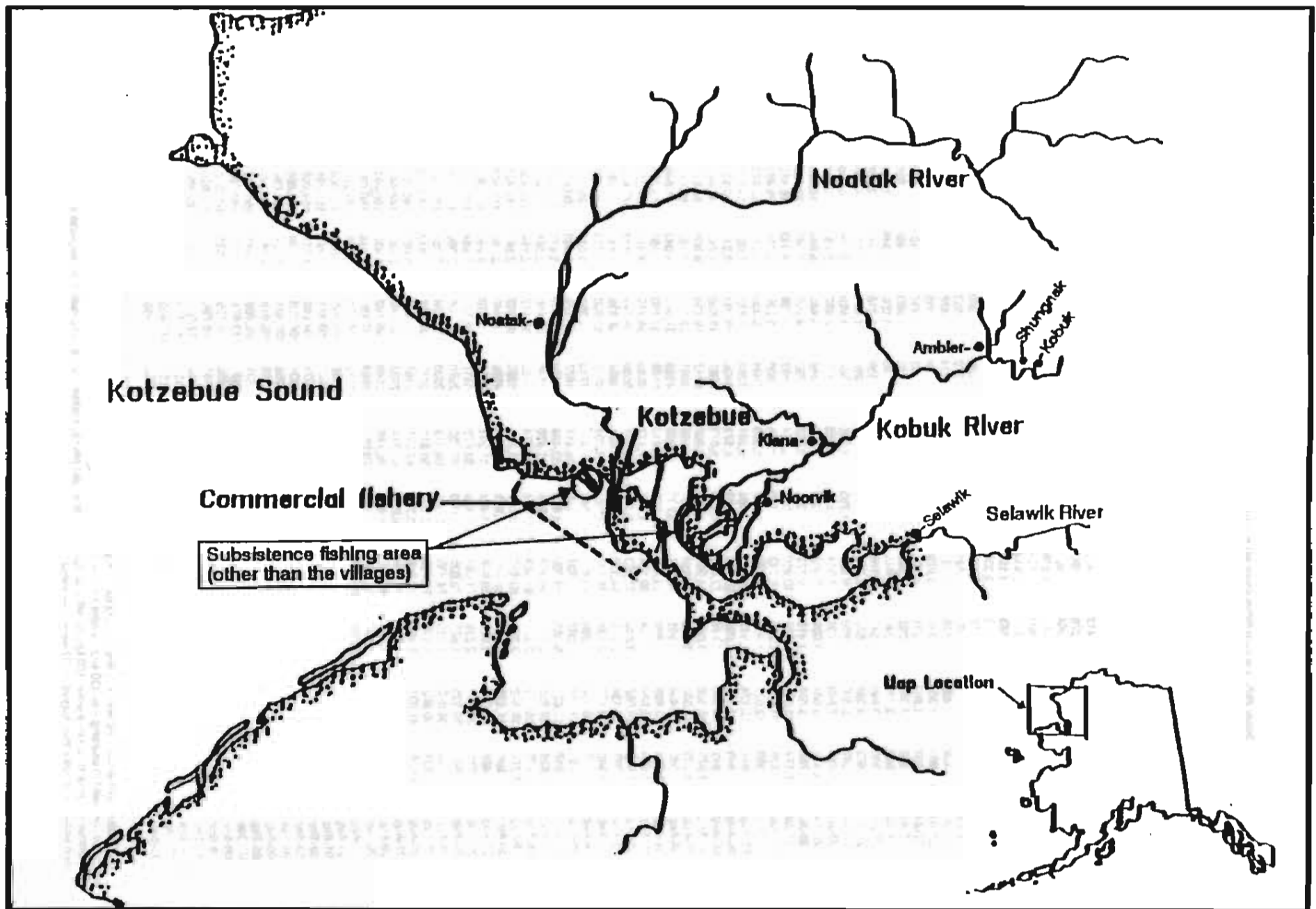


Figure 1. Kotzebue Sound commercial fishing district. Commercial fishing areas and subsistence fishing areas.

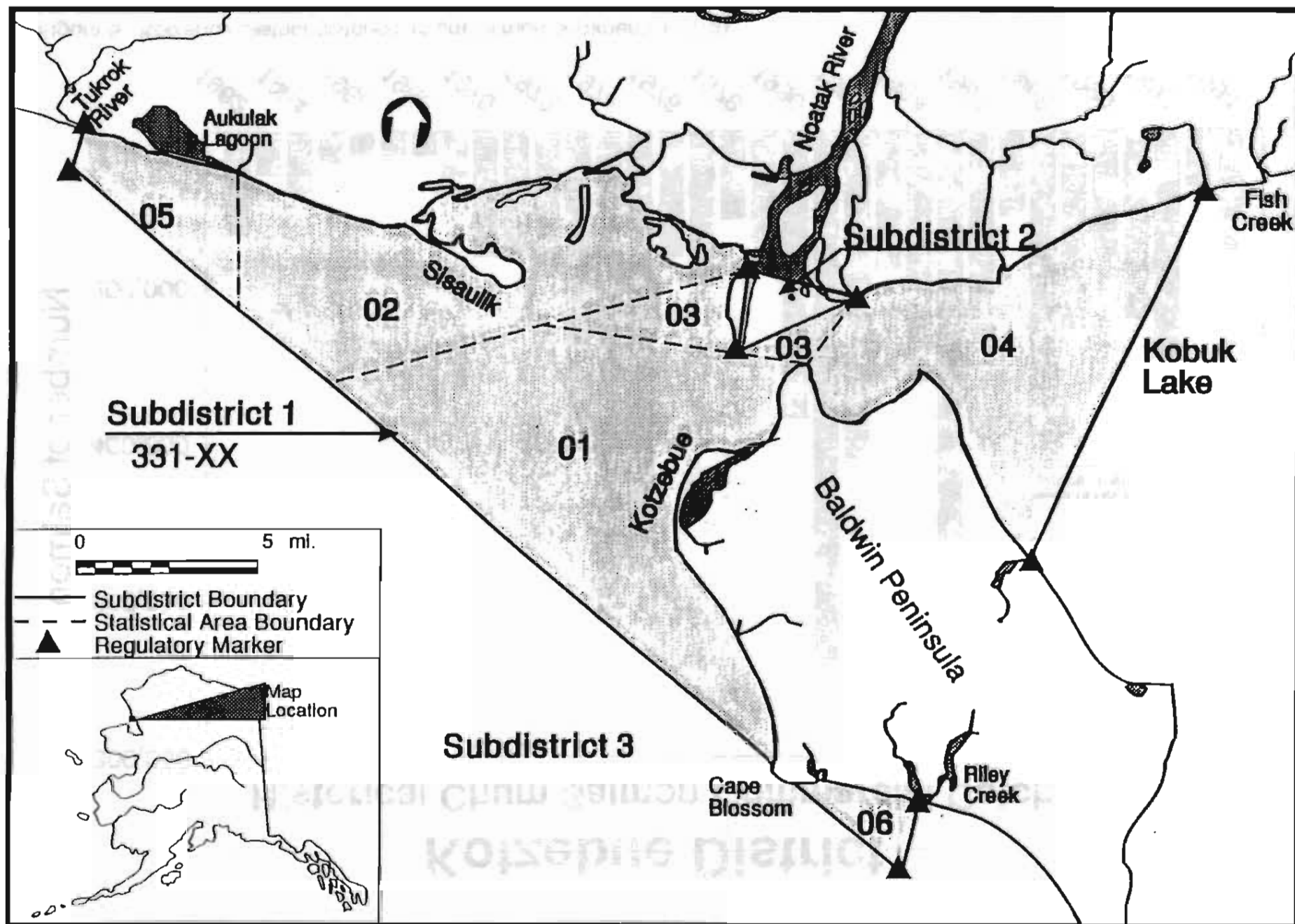


Figure 4. Kotzebue Sound commercial fishing subdistricts and statistical areas.

Kotzebue District

Historical Chum Salmon Commercial Catch

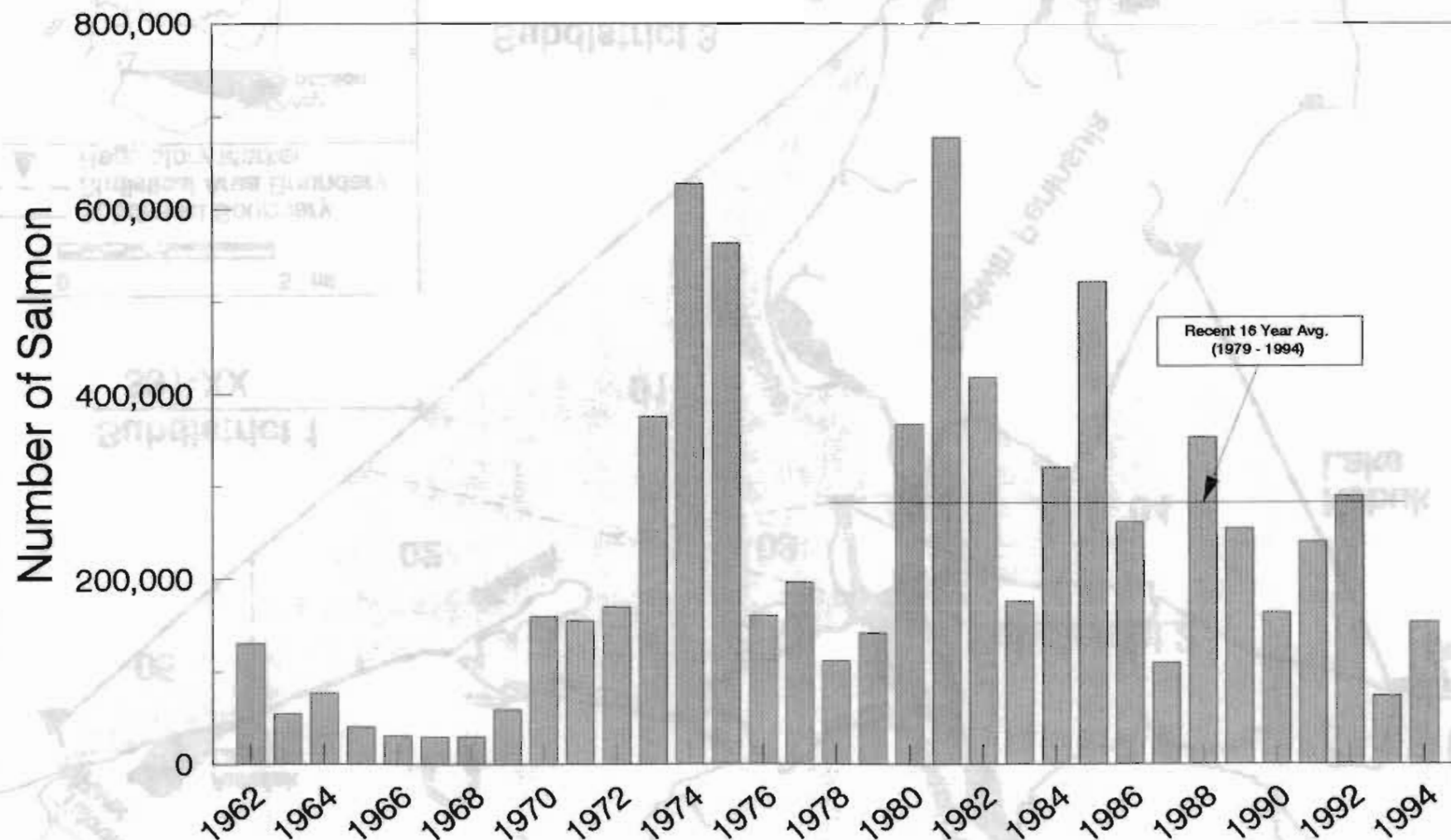


Figure 5. Kotzebue District historical chum salmon commercial catch.

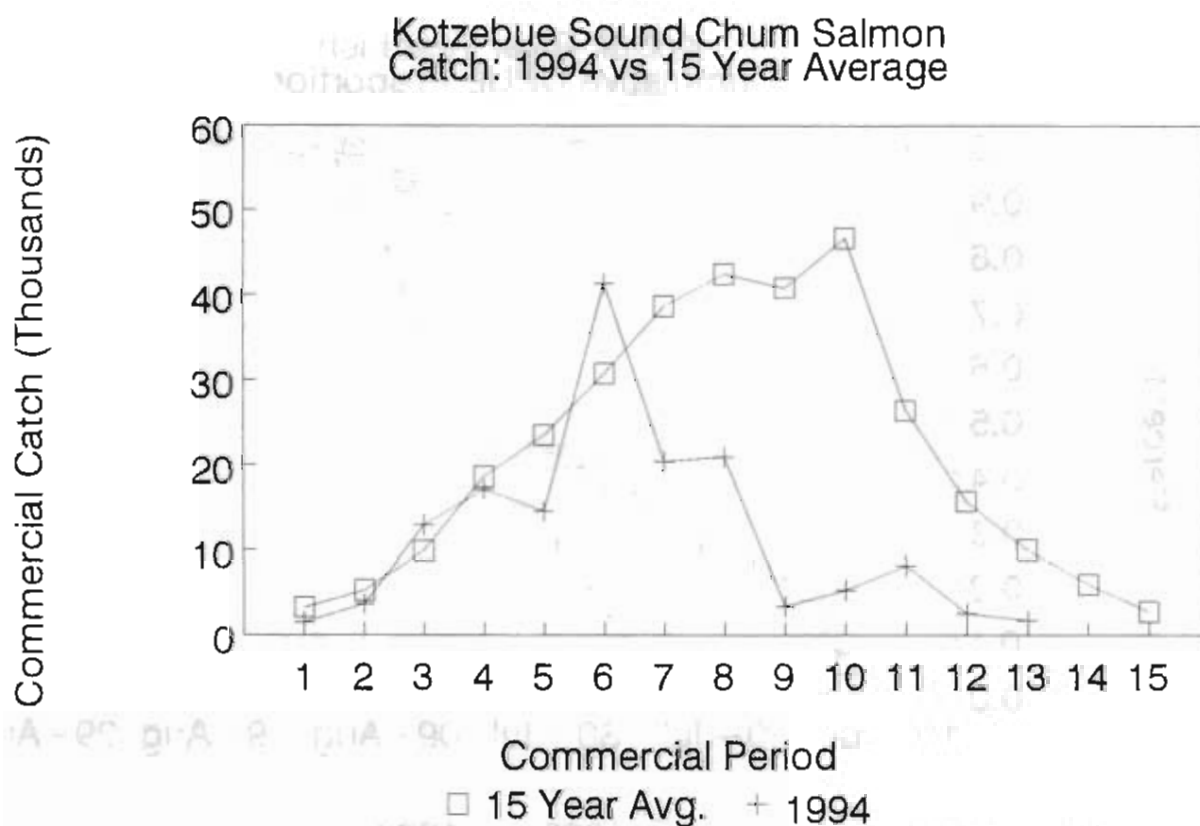
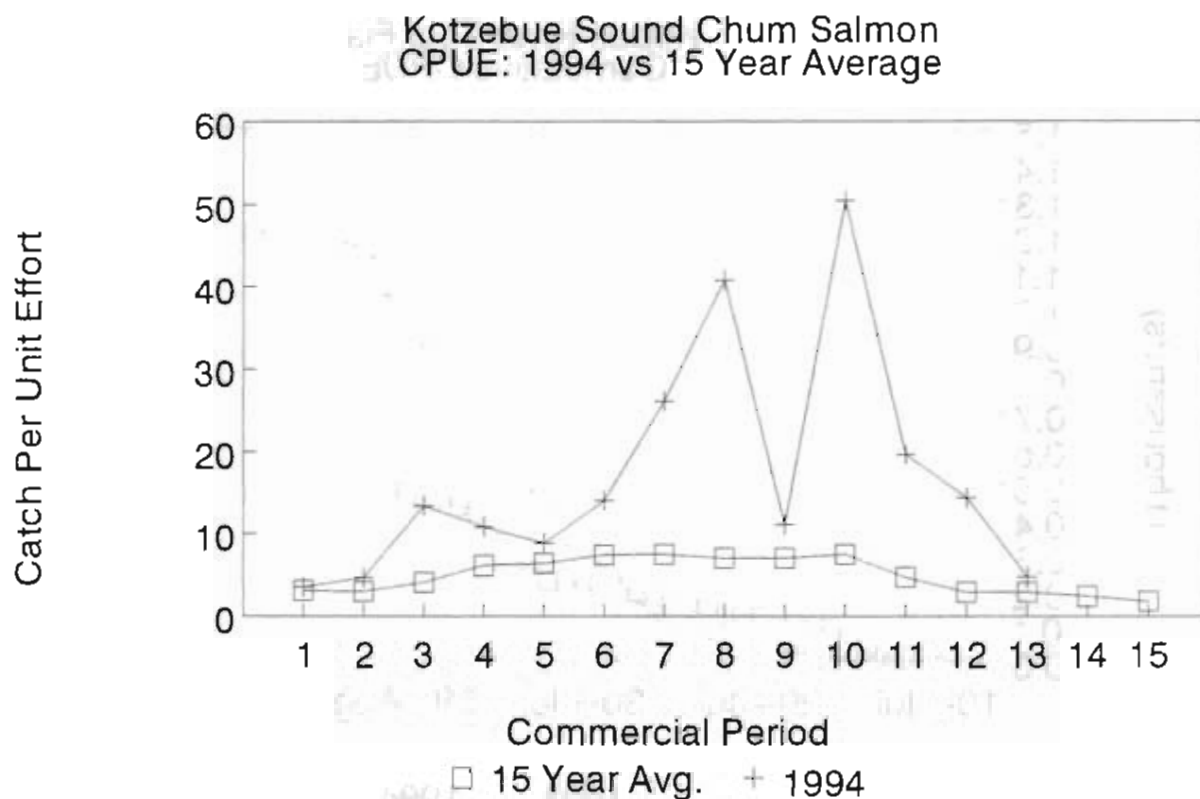


Figure 6. Kotzebue District previous 15 year average (1979–1993) and 1994 catch and catch per unit effort comparisons.

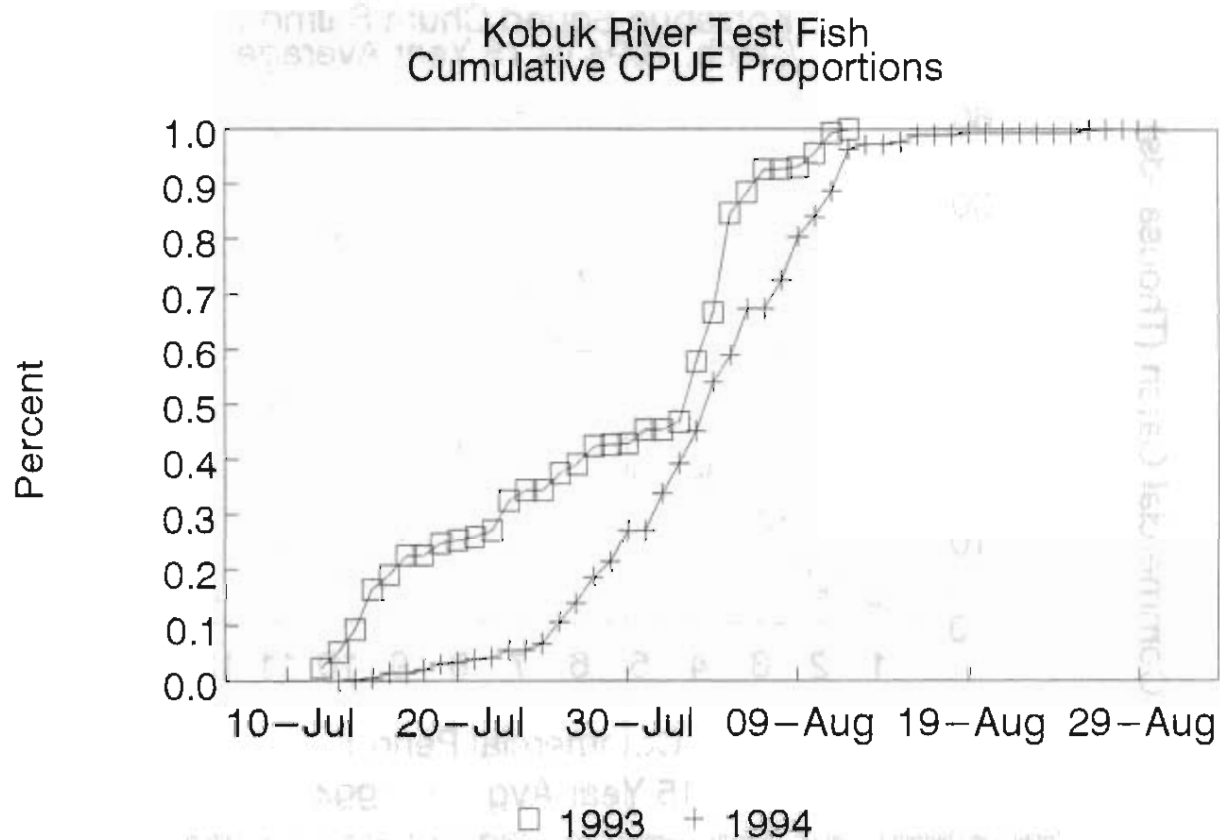
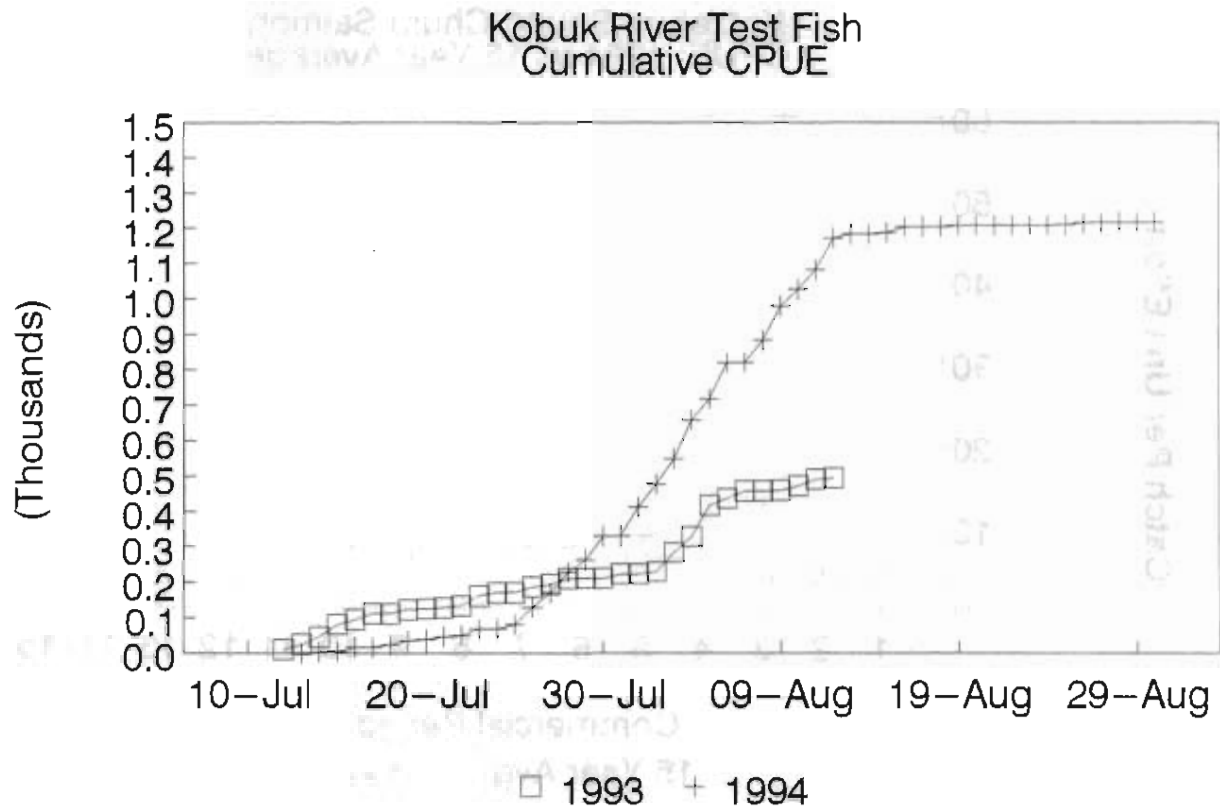


Figure 7. Kobuk River chum salmon drift test fish cumulative CPUE and proportions for 1993–1994.

Noatak River Sonar Cumulative Chum Salmon Counts

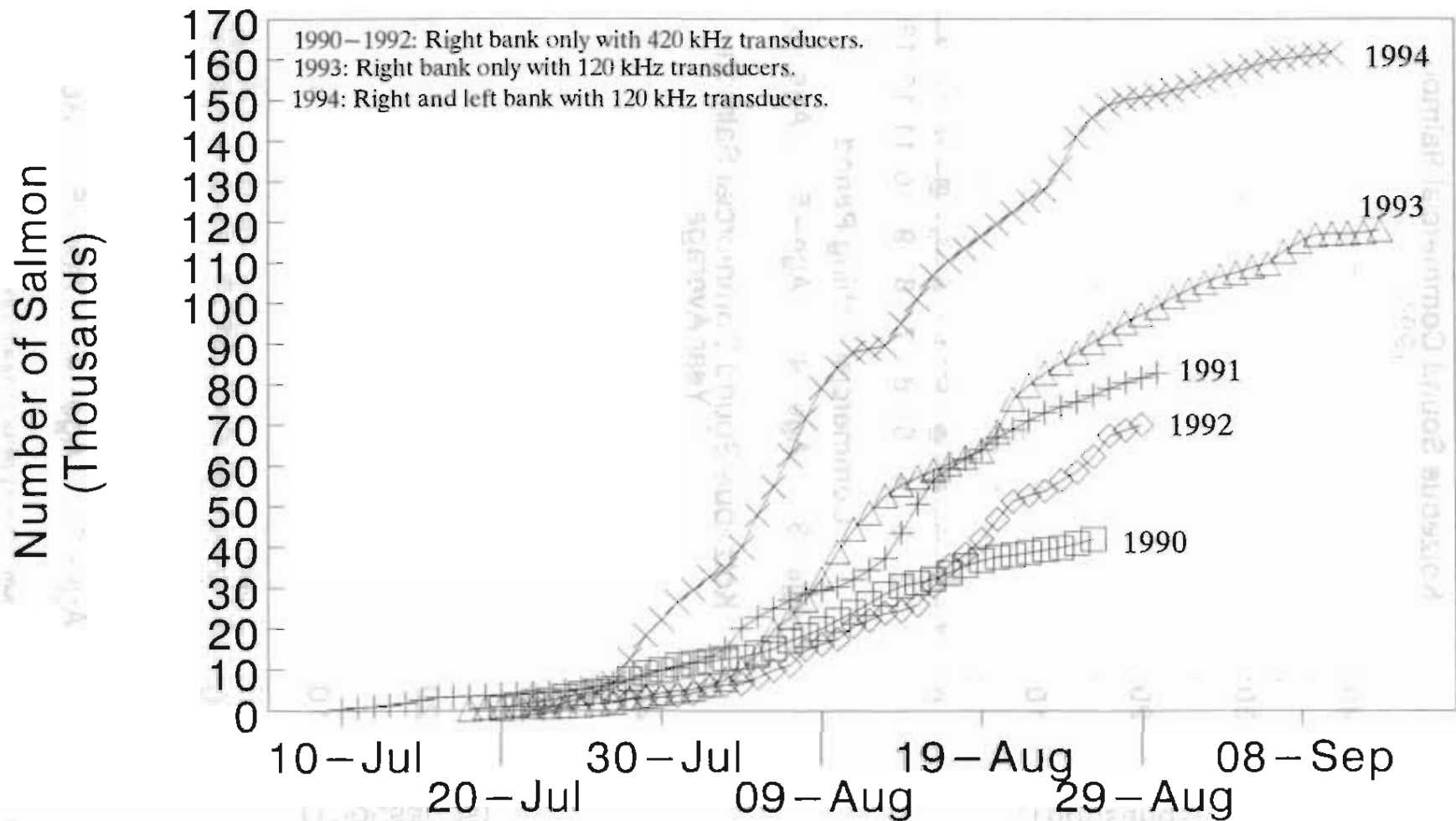


Figure 8. Noatak River chum salmon cumulative sonar counts from 1990–1994.

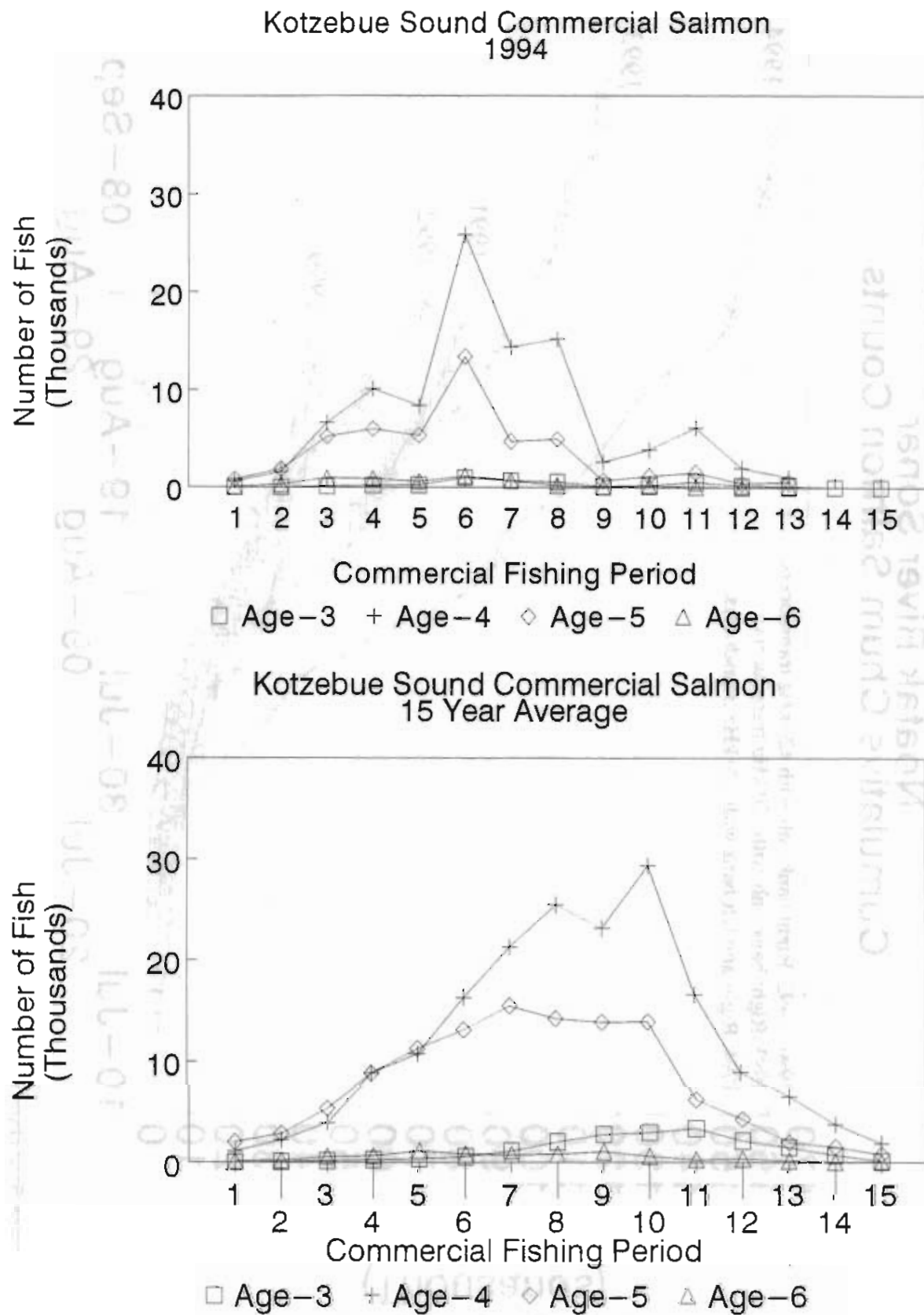


Figure 9. Age in numbers of chum salmon by period comparing the recent 15 year average (1979–1993) to 1994.

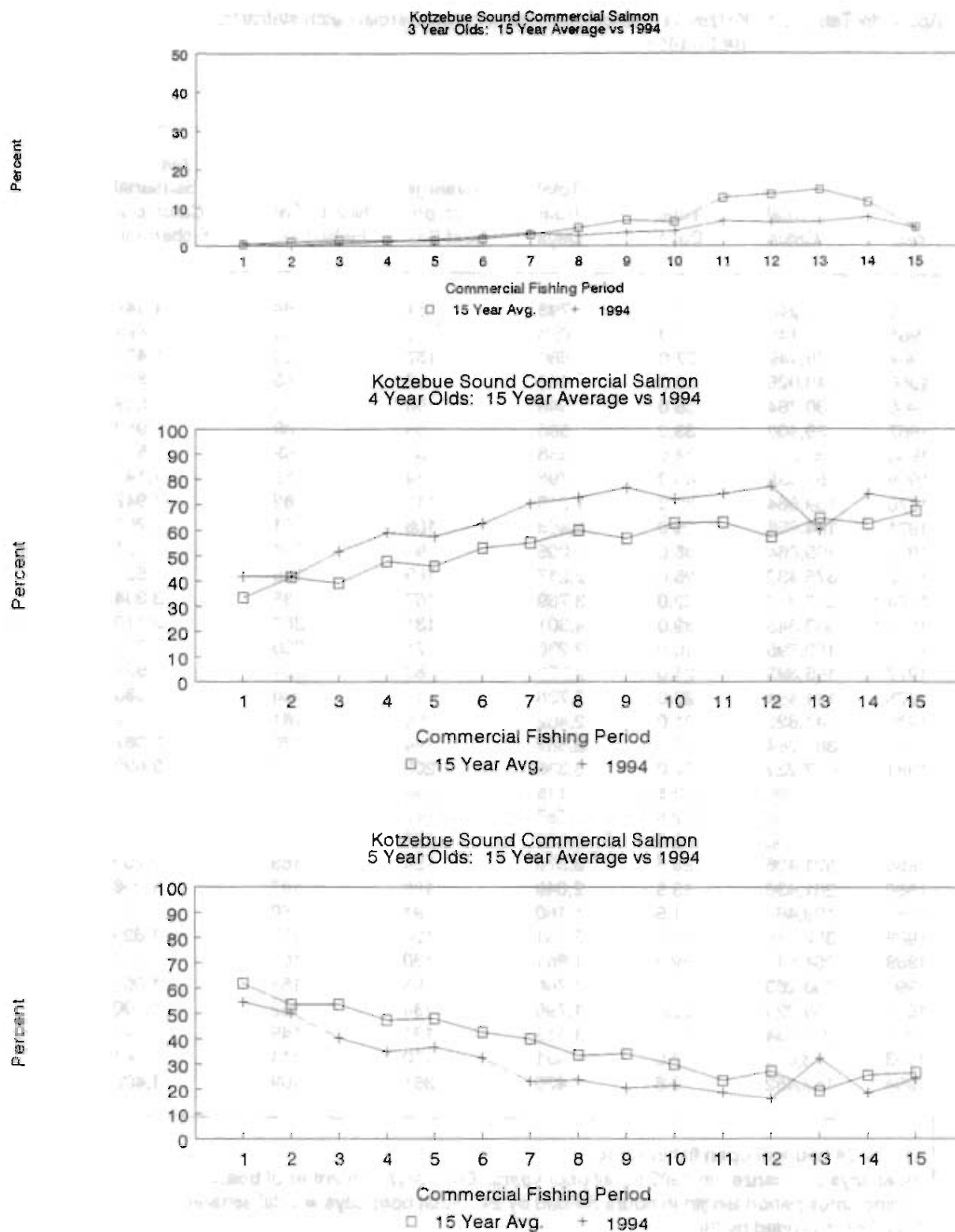


Figure 10. Age composition of chum salmon by period comparing the recent 15 year average (1979–1993) to 1994.

Appendix Table C.1. Kotzebue District chum salmon commercial catch statistics, 1962–1994.

Year	Total Catch	Total Days ^a	Total Boat Days ^b	Average Catch per Boat Day	Number of Fishermen ^c	Average Seasonal Catch per Fishermen
1962	129,948	21.0	793	164	84	1,547
1963	54,445	20.0	693	79	61	893
1964	76,449	27.0	560	137	52	1,470
1965	40,025	32.0	410	98	45	889
1966	30,764	35.0	548	56	44	699
1967	29,400	33.0	556	53	30	980
1968	30,212	34.0	858	35	59	512
1969	59,335	40.0	798	74	52	1,141
1970	159,664	32.0	1,368	117	82	1,947
1971	154,956	29.0	1,468	106	91	1,703
1972	169,664	35.0	2,095	81	104	1,631
1973	375,432	25.0	2,217	169	148	2,537
1974 ^d	627,912	32.0	3,769	167	185	3,394
1975 ^e	563,345	39.0	4,301	131	267	2,110
1976	159,796	16.0	2,236	71	220	726
1977	195,895	21.0	2,353	83	224	875
1978	111,494	23.0	2,738	41	208	536
1979	141,623	21.0	2,462	58	181	782
1980	367,284	27.0	2,559	144	176	2,087
1981	677,239	27.0	3,336	203	187	3,622
1982	417,790	23.5	3,115	134	199	2,099
1983	175,762	12.5	1,557	113	189	930
1984	320,206	19.5	2,432	132	181	1,769
1985	521,406	25.5	3,376	154	189	2,759
1986	261,436	15.5	2,049	128	187	1,398
1987	109,467	11.5	1,160	94	160	684
1988	352,915	21.5	2,761	128	193	1,829
1989	254,617	22.2	1,961	130	165	1,543
1990	163,263	11.5	1,760	93	153	1,067
1991	239,923	22.5	1,795	134	142	1,690
1992	289,184	17.0	1,513	191	149	1,941
1993 ^f	73,071	7.0	431	170	114	641
1994 ^g	153,452	9.8	426	361	109	1,408

^a Day = 24 hours of open fishing time.

^b Boat days standardized in 1983 for all prior years. Boat days = number of boats fishing times period length in hours divided by 24. Total boat days = total season boat hours divided by 24.

^c During 1962–1966 and 1968–1971 figures represent the number of vessels licensed to fish in Kotzebue District, not the number of fishermen.

^d Includes 6,567 chum salmon from the Deering experimental fishery.

^e Includes 10,704 chum salmon from the Deering experimental fishery.

^f Includes 2,000 chum salmon from the Sikusuiq Springs Hatchery terminal fishery.

^g Includes 4,000 chum salmon commercially caught but not sold on July 29.

Appendix Table C.2. Kotzebue District chum salmon type of processing and weights, 1962–1994.

Year	Chum Salmon			Fresh Frozen Salmon Roe (pounds)	Cured Pounds
	Cases (48lbs)	Fresh Frozen (Round weight in pounds)	Other ^a		
1962	14,500				
1963	5,396				
1964	5,421	202,993			
1965	1,929	207,350			
1966		310,716		13,600	3,065
1967		273,420			11,488
1968		288,500			11,850
1969		455,013			8,183
1970		1,240,000			48,377
1971		1,264,753			27,542
1972		1,547,041			55,376
1973		3,416,431			144,768
1974		5,361,130 ^b			
1975		4,877,313 ^c			
1976		1,415,549	487		
1977		1,846,340	1,075		
1978		1,009,121	32,419		
1979		1,236,429	6,155		
1980		3,160,948	7,828		
1981		6,139,518	2,210		
1982		3,833,051	790	100	
1983		1,647,160	2,449		
1984		2,631,582	1,593		
1985		4,528,379	1,106		
1986		2,271,320	1,691		
1987		900,405	597		
1988		3,060,292	2,120		
1989		2,163,174	1,426		
1990		1,453,040	538		
1991		1,951,041	714		
1992		2,397,302	2,714		
1993 ^d		613,968	1,507	1,000	
1994 ^d		1,166,494	73		

^a Chinook and pink salmon.

^b Includes 36,775 pounds from the experimental commercial fishery at Deering.

^c Includes 80,801 pounds from the experimental commercial fishery at Deering.

^d Includes 11,160 pounds from the Sikusuilaq Springs Hatchery terminal fishery. Pounds of roe stripped are from a verbal report.

^e Includes 31,500 pounds commercially caught but not reported on fish tickets.

Appendix Table C3. Kotzebue District commercial fishery dollar value estimates, 1962–1994.^a

Year	Gross Value of Catch to Fishermen	Wholesale Value of Pack ^b	License and Tax Revenue to State
1962	\$4,500	\$304,500	\$11,635
1963	\$9,140	\$113,316	\$6,040
1964	\$34,660	\$158,020	\$5,279
1965	\$18,000	\$83,294	\$2,952
1966	\$25,000	\$84,630	\$2,820
1967	\$28,700	\$100,450	\$4,245
1968	\$46,000	\$62,000	\$2,800
1969	\$71,000		
1970	\$186,000		\$5,520
1971 ^c	\$200,000		\$5,970
1972 ^d	\$260,000		
1973	\$925,000		
1974	\$1,822,784		\$18,121
1975	\$1,365,648		\$16,955
1976	\$580,375		\$15,364
1977	\$1,033,950		\$19,960
1978	\$575,260		\$9,913 ^e
1979	\$990,263		\$18,302 ^e
1980	\$1,446,633		\$11,820 ^e
1981	\$3,246,793		\$11,220 ^e
1982	\$1,961,518		\$7,085 ^e
1983	\$420,736		\$24,097 ^e
1984	\$1,148,884		\$39,696 ^e
1985	\$2,137,368		\$7,020 ^f
1986	\$931,241		\$7,020 ^f
1987	\$515,000		\$7,110 ^f
1988	\$2,581,333		\$11,790 ^f
1989	\$613,823		\$11,750 ^f
1990	\$438,044		\$11,770 ^f
1991	\$437,948		\$11,820 ^f
1992	\$533,731		\$11,615 ^f
1993 ^b	\$235,061		\$11,795 ^f
1994	\$233,512		\$11,420 ^f

^a Some estimates between 1962 and 1981 include only chum value which in figures represent over 99% of the total value. Figures after 1981 represent the chum value as well as incident species such as char, whitefish and other salmon species.

^b Based on type of processing when fish were shipped out of the district.

^c Includes \$9,193 from the experimental commercial fishery at Deering.

^d Includes \$17,776 from the experimental commercial fishery at Deering.

^e Includes permit and vessel fees only.

^f Information not available.

^g Includes permit renewal fees only; vessels were not required.

^h Includes \$3,648 from the Sikusuilaq Springs Hatchery terminal fishery.

Appendix Table C.4. Kotzebue District mean prices paid per pound to salmon fishermen by species, 1962-1994.^a

Year	Chum Salmon		Chinook Salmon	Pink Salmon	Inconnu	Dolly Varden
	Average Weight	Average Price				
1962		\$0.35 ^c				
1963		\$0.35 ^c				
1964	8.3	\$0.45 ^c				
1965	9.0	\$0.45			\$1.30 ^c	
1966	10.1	\$0.11			\$1.40 ^c	\$0.55
1967	9.3	\$0.11			\$1.50 ^c	\$0.75
1968	9.7	\$0.14			\$0.91 ^c	\$0.98
1969	7.5	\$0.15			\$1.30 ^c	\$2.84
1970	8.1	\$0.15				
1971	8.1	\$0.16			\$0.16	\$0.17
1972	9.1	\$0.17			\$0.20	\$0.17
1973	9.1	\$0.25			\$0.30	\$0.16
1974 ^b	8.5	\$0.34			\$0.30	\$0.16
1975 ^b	8.6	\$0.28			\$0.30	\$0.30
1976	8.9	\$0.41			\$0.30	\$0.30
1977	9.6	\$0.56			\$0.30	
1978	9.1	\$0.57			\$0.30	\$0.25
1979	8.8	\$0.80				\$0.25
1980	8.6	\$0.46			\$0.10	\$0.20
1981	9.1	\$0.53			\$0.75 ^d	\$0.17
1982	9.3	\$0.51	\$1.25	\$0.15	\$0.75 ^d	\$0.20
1983	9.4	\$0.25	\$1.08	\$0.13		\$0.20 ^d
1984	8.2	\$0.44	\$1.03			\$0.25 ^d
1985	8.7	\$0.47	\$1.25			\$0.25
1986	8.7	\$0.41	\$1.25			\$0.20
1987	8.2	\$0.57	\$1.25			\$0.30
1988	8.7	\$0.85	\$1.98			\$0.35
1989	8.5	\$0.28	\$1.72			\$0.28
1990	8.9	\$0.31	\$2.00			\$0.25
1991	8.1	\$0.22	\$1.64		\$0.50	\$0.18
1992	8.3	\$0.22	\$1.89		\$0.58	\$0.10
1993	8.5	\$0.38	\$2.37		\$0.50	\$0.10
1994	7.8	\$0.20	\$1.14			\$0.17

^a Information not available for some species in some years.

^b Includes price paid to fisherment of Deering during the experimental commercial fishery.

^c Price per fish.

^d Limited market with one buyer.

Appendix Table C.5. Kotzebue District commercial and subsistence salmon catches, 1914-1994.

Year.	Commercial Catch			Subsistence Chum Catch			
	Chum.	Other.	Total	Chum	Number of Fishermen Interview	Average Catch per Fishermen	Total Documented Catch
1914	8,550		8,550				
1915	4,750		4,750				
1916	19,000		19,000				
1917	44,612		44,612				
1918	27,407		27,407				
1957				298,430 ^a			
1962	129,948	27	129,975	70,283	81	868	200,258
1963	54,445	143	54,588	31,069	67	484	85,657
1964	76,499	5	76,504	29,762	58	513	106,266
1965	40,034		40,034	30,500	89	343	70,534
1966	30,764	1	30,765	35,588	121	294	66,353
1967	29,400		29,400	40,108	135	297	69,508
1968	30,384		30,384	20,814	65	320	51,198
1969	59,335	48	59,383	29,812	99	301	89,195
1970	159,664		159,664	28,486	164	174	188,150
1971	154,956	1	154,957	23,959	152	158	178,916
1972	169,664	3	169,667	11,085	96	115	180,752
1973	375,432	5	375,437	18,942	101	188	394,379
1974	634,479	48	634,527	26,729	88	304	661,256
1975	563,682	36	563,718	27,605	95	291	591,323
1976	159,796	2	159,798	15,765	91	173	175,563
1977	195,895		195,895	9,752	83	117	205,647
1978	111,494	7,007	118,501	12,864	85	151	131,365
1979	141,623	910	142,533	14,605	97	151	157,138
1980	367,284	1,654	368,938	10,945	111	99	379,883
1981	677,239	237	677,476	17,766	71	250	695,242
1982	417,790	57	417,847	30,133	204	148	447,980
1983	175,762	229	175,991	8,262 ^b	46	180	184,253
1984	320,206	107	320,313	15,508 ^b	66	235	335,821
1985	521,406	63	521,469	13,494 ^c	243	56	534,963
1986	261,436	106	261,542	36,311	837	43	297,853
1987	109,467	44	109,511				109,511
1988	352,915	152	353,067				353,067
1989	254,617	87	254,704				254,704
1990	163,263	32	163,295				163,295
1991	239,923	44	239,967				239,967
1992	289,184	204	289,388				289,388
1993	73,071 ^d	131	73,202				73,202
1994	153,452 ^e	3	153,455	37,232 ^f	375	99	190,687
1979-94							
Average	282,415	254	282,669				

^a There was no commercial fishing during 1919-1961.

^b Catches for 1914-1918 are from pack data only. Number of chum salmon estimate at 9.5 per case (#48) and 34 per barrel.

^c Includes pink, chinook, and sockeye salmon.

^d Estimated mean annual catches prior to 1957 (study by Raleigh).

^e Corrected from 1968 annual report due to addition of late catches.

^f Includes 6,567 chum salmon from the Deering experimental fishery.

^g Includes 10,704 chum salmon from the Deering experimental fishery.

^h Partial survey.

ⁱ Does not include harvest from the villages of Noatak and Kivalina.

^j Not surveyed.

^k Includes 2,000 chum salmon from the Sikusuilag Springs Hatchery terminal fishery.

^l Includes 4,000 chum salmon commercially harvested on July 29 but not sold.

^m Catch estimates does not include households in Kotzebue (see Apx. C.6 and C.7).

Appendix Table C.6. Kotzebue District subsistence chum salmon catches by village, 1962-1994.

Year	Village					Village								District Total
	Noorvik	Kiana	Ambler	Shungnak	Kobuk	Kobuk River	Noatak Village	Kotzebue	Deering	Kivalina	Buckland	Candle	Shishmaref	
1962	15,934	3,139	b	b	2,321	21,394	46,890	b	b	b	b	b	b	70,284
1963	4,304	1,973	755	1,240	200	8,472	16,762	5,835	b	b	b	b	b	31,069
1964	2,167	783	2,142	3,134	1,020	9,246	12,763	7,753	b	b	b	b	b	29,762
1965	5,596	1,598	1,340	2,160	877	11,571	5,671	8,058	5,200	b	b	b	b	30,500
1966	3,141	433	912	899	625	6,010	19,700	3,640	6,238	b	b	b	b	35,588
1967	2,350	1,489	679	1,500	175	6,193	26,512	4,032	3,098	b	162	11	100	40,108
1968	2,424	2,488	457	1,600	1,030	7,999	5,490	4,324	2,838	b	37	89	37	20,814
1969	1,301	2,458	3,525	2,550	1,655	11,489	14,458	1,768	1,897	b	-	200		29,812
1970	6,077	3,457	2,899	3,450	600	16,483	4,120	6,814	1,242	b	344	113		29,116
1971	7,144	5,177	2,299	2,653	1,931	19,204	9,919	1,737	763	b	155	50	131	31,959
1972	1,744	1,435	1,469	2,665	2,119	9,432	741	1,151	369	b	59	113	29	11,894
1973	2,312	4,470	1,529	4,408	1,917	14,634	216	1,172	1,098	b	1,722	50	100	18,992
1974	6,809	2,726	1,651	6,243	2,251	19,680	4,330	b	1,880	b	639	15	200	26,744
1975	4,620	4,320	3,390	9,060	1,755	23,145	1,515	b	1,175	b	1,540	b	230	27,605
1976	1,555	1,579	2,000	4,213	562	9,909	4,448	b	1,358	b	b	b	b	15,715
1977	891	766	385	1,760	325	4,127	2,125	b	3,500	b	b	b	b	9,752
1978	2,034	1,493	2,224	4,766	852	11,369	1,495	b	b	b	b	50	b	12,914
1979	2,155	1,225	2,400	2,947	651	9,378	2,227	b	2,000	b	1,000	b	b	14,605
1980	2,229	2,551	660	2,704	350	8,494	2,135	b	b	b	b	b	b	10,629
1981	3,488	1,439	782	2,800	950	9,459	5,465	2,387	295	110	50	b	b	17,766 ^{ac}
1982	7,433	4,918	2,506	4,191	600	19,648	5,479	4,099	807	210	b	b	b	30,243 ^a
1983 ^{ad}	277	223	1,062	3,556	368	5,486	4,035	347	219	200	b	b	b	10,287
1984 ^{ae}	b	b	2,990	4,241	b	7,231	6,049	88 ^a	1,940	200	b	b	b	15,508
1985	7,015	3,494	3,487	3,115	300	17,411	b	13,494	573	b	b	b	b	31,478
1986	8,418	b	b	4,483	b	12,901	1,246	36,311	b	b	b	b	b	50,458
1987	5,092	b	b	1,975	b	7,067	2,921	b	b	b	b	b	b	9,988
1988	7,500	b	b	6,223	b	13,723	b	b	b	b	b	b	b	13,723
1989	b	b	b	3,894	b	3,894	1,595	b	b	b	b	b	b	5,489
1990	4,353	b	b	b	b	4,353	3,915	b	b	b	b	b	b	8,268
1991	6,855	b	b	4,248	b	11,103	3,637	b	b	b	b	b	b	14,740
1992	8,370	b	b	3,890	b	12,260	2,043	b	b	b	b	b	b	14,303
1993	8,430	b	b	3,730	b	12,160	3,270	b	b	b	b	b	b	15,430
1994 ^f	8,417	1,889	2,750	7,965	5,722	26,743	6,126	b	3,488	b	b	b	b	36,357

^a No household survey, information is from return of mail questionnaires.^b Not surveyed.^c Does not include 310 chum salmon taken in Selawik.^d Household surveys were conducted in Noatak, Kivalina, and Shungnak only. Other harvest information is from limited return of mail-in calendars.^e Household surveys were conducted in Noatak, Kivalina, Ambler, and Deering. Other harvest information is from limited return of mail-in questionnaires.^f Preliminary information based on interviews conducted by Division of Subsistence.

Appendix Table C.7. Kotzebue District mean subsistence chum salmon catch per fishermen by village, 1962-1994.

Year	Kotzebue	Noatak	Noorvik	Kiana	Ambler	Shungnak	Kobuk	Deering
1962	a	1,190	665	350	a	a	335	a
1963	650	800	160	b	94	b	67	a
1964	515	710	220	260	310	a	205	a
1965	400	810	220	265	190	220	145	a
1966	158	820	137	62	76	45	104	a
1967	202	914	90	68	49	125	35	a
1968	135	220	84	96	33	114	206	a
1969	98	760	163	223	235	318	206	a
1970	187	242	132	138	242	182	150	a
1971	53	148	223	207	177	133	386	a
1972	63	74	84	84	244	266	302	a
1973	195	36	121	178	305	489	273	a
1974	a	393	324	181	165	891	450	a
1975	a	138	210	288	282	647	293	a
1976	a	212	259	79	250	281	70	a
1977	a	425	56	38	55	104	41	a
1978	a	79	88	71	131	265	142	a
1979	a	114	98	68	160	184	108	a
1980	a	164	318	213	132	246	88	a
1981	213	579	388	131	129	233	317	a
1982	84	189	323	246	167	262	200	81
1983 ^c	50	269	139	223	531	254	368	44
1984	44	173	a	a	214	303	a	194
1985	107	a	206	116	152	195	50	72
1986	47	69 ^d	271	a	a	195	a	a
1987	a	225 ^d	189	a	a	329	a	a
1988	a	a	300	a	a	389	a	a
1989	a	133	a	a	a	216	a	a
1990	a	135	198	a	a	a	a	a
1991	a	145	311	a	a	283	a	a
1992	a	89	310	a	a	243	a	a
1993	a	136	312	a	a	196	a	a
1994 ^e	a	90	153	36	102	177	337	92

a Not Surveyed.

b Number of fishermen not known.

c Means based on very limited number of mail-in calendars except for the villages of Noatak and Shungnak where interviews were conducted.

d Partial harvest, fishermen were just beginning to fish.

e Preliminary information based on interviews conducted by Division of Subsistence.

Appendix Table C.8. Chum salmon aerial survey counts for the Kotzebue District, 1962–1994^{a,h}. (p. 1 of 4)

Stream	1962	1963	1964	1965	1966	1967	1968	1969
Noatak Drainage								
Noatak River below Kelly River	168,000 ^d	1,970 ^{b,j}	89,798	6,152 ^{b,j}	101,640	29,120 ^b	39,394	33,945
Eli River	9,080 ^d	35			120		5,502 ^f	68 ^f
Kelly River & Lake	1,818 ^d	600		3,155	570	225	375	150
Noatak River System Total	178,898	2,605	89,798	9,307	102,330	29,345	45,271	34,163
Kobuk Drainage								
Kobuk to Pah River		400		1,750	266		530	
Pah River to just below Selby River		1,530		500			50	
Selby River mouth & Slough		1,045		500	630	1,625	70	
Selby R. mouth to just below Beaver C.		1,095				75	170	
Beaver Creek mouth					460	795	1,550	
Above Beaver Creek		465			118			
Upper Kobuk River Total	9,224 ^d	4,535	7,985 ^g	2,750	1,474	2,495	2,370	7,500 ^c
Squirrel River	5,834 ^d	2,200	8,009	7,230	1,350	3,332	6,746	6,714
Salmon River	12,936 ^d	1,535	9,353	1,500 ^b	3,957	2,116	3,367	2,561
Tutuksuk River	10,841 ^d	670	2,685		1,383	169	823 ^h	159
Kobuk River System Total	38,835 ^c	8,940	28,032	11,480	8,164	8,112 ^c	13,306	16,934

^a Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indices listed in this table are the largest survey observed for each tributary during the given year.

^b Poor survey conditions or incomplete, early or late survey.

^c Survey by foot or boat.

^d These fish are unidentified salmon, mostly chums.

^e This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.

^f Unresolvable discrepancies in historical data put this figure in question.

^g Unclear where these fish were observed.

^h The figures in this table have been corrected and supercede figures in previous reports.

ⁱ Surveyed well before peak of migration.

^j Unacceptable conditions.

Appendix Table C.8. (p. 2 of 4)

Stream	1970	1971	1972 ^b	1973 ^b	1974	1975	1976	1977 ^b	1978	1979
Noatak Drainage										
Noatak River below Kelly River	138,145	41,056	64,315	32,144	129,640	96,509	44,574	11,221	37,817	15,721 ^b
Eli River			3,286		22,249	1,302	1,205	742	5,525	1,794
Kelly River & Lake				2,590 ^f	1,381 ^f	3,937	217 ^b	290 ^b	168 ^b	3,200 ^b
Noatak River System Total	138,145	41,056	64,315 ^b	34,734	153,270	101,748	45,996	12,253 ^b	43,510	20,715
Kobuk Drainage										
Kobuk to Pah River	1,753	4,953			2,255	1,873	485		269	75
Pah River to just below Selby River	20	2,039	1,865		4,710	3,968	2,037		1,448	183
Selby River mouth & Slough	4,820	3,490	7,400		7,380				211	1,110
Selby R. mouth to just below Beaver C.	2,385	4,720	3,170	920	13,775 ^c	4,861 ^c			53	640
Beaver Creek mouth	4,930	2,000	3,000	850						
Above Beaver Creek			2,720	700						
Upper Kobuk River Total	13,908	17,202	18,155	2,470 ^b	28,120	10,702	2,522 ^b		1,981 ^b	2,008
Squirrel River	4,418	6,628	32,126	12,345	32,523	32,256	7,229	1,964 ^b	1,863 ^b	1,500 ^b
Salmon River	3,000 ^b	5,453	2,073 ^b	6,891	29,190	9,721	1,161		814 ^b	674 ^b
Tutuksuk River	2,000 ^b	1,384 ^f			8,312	1,344 ^b	758		368 ^b	382 ^b
Kobuk River System Total	23,326	30,667	52,354	21,706	98,145	54,023	11,670	1,964	5,026	4,564

^a Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indices listed in this table are the largest survey observed for each tributary during the given year.

^b Poor survey conditions or incomplete, early or late survey.

^c Survey by foot or boat.

^d These fish are unidentified salmon, mostly chums.

^e This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.

^f Unresolvable discrepancies in historical data put this figure in question.

^g Unclear where these fish were observed.

^h The figures in this table have been corrected and supercede figures in previous reports.

ⁱ Surveyed well before peak of migration.

^j Unacceptable conditions.

Appendix Table C.8. (p. 3 of 4)

Stream	1980	1981 ^a	1982 ^b	1983	1984	1985 ^b	1986 ^b	1987 ^b	1988 ^b	1989 ^c
Noatak Drainage										
Noatak River below Kelly River	164,474	116,352	20,682	79,773	67,873	45,525	37,227	5,515 ^d	45,930 ^e	
Eli River	10,277		189	3,044	5,027	855	4,308	2,780	8,639	
Kelly River & Lake	7,416	13,770	11,604	12,137	3,499	1,200	839	950	1,460	
Noatak River System Total	182,167	130,122	32,475	94,954	76,399	47,580	42,374	9,245	56,029	
Kobuk Drainage										
Kobuk to Pah River	1,694	18	2,643 ^b	2,147	402	2,048 ^f	531			
Pah River to just below Selby River	2,069	309	598 ^h	2,433	257	241 ⁱ	511	2,250	1,135 ^b	
Selby River mouth & Slough		8,321 ^d	2,454	11,683		711 ⁱ	673	1,470	820 ^h	
Selby R. mouth to just below Beaver C.	6,925 ^d		7,268	13,011	5,910	3,278 ⁱ	3,282	1,350	6,890 ^h	
Beaver Creek mouth	784		1,711	3,059						
Above Beaver Creek				1,413	4,052		1,018	3,140	3,050 ^h	
Upper Kobuk River Total	11,472	8,648	14,674	33,746	10,621	6,278	6,015	8,210	11,895 ^b	
Squirrel River	13,563	9,854	7,690	5,115	5,473	6,160	4,982	2,708 ^c	4,848 ^b	
Salmon River	8,456	4,709	1,821 ^c	1,677	1,471	2,884	1,971	3,333	6,208	
Tutuksuk River	1,165	1,114	1,322	2,637	1,132	5,098	4,257	206	3,122	
Kobuk River System Total	34,656	24,325	25,507	43,175	18,697	20,420	17,225	14,457	26,073	

^a Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indices listed in this table are the largest survey observed for each tributary during the given year.

^b Poor survey conditions or incomplete, early or late survey.

^c Survey by foot or boat.

^d These fish are unidentified salmon, mostly chums.

^e This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.

^f Unresolvable discrepancies in historical data put this figure in question.

^g Unclear where these fish were observed.

^h The figures in this table have been corrected and supercede figures in previous reports.

ⁱ Surveyed well before peak of migration.

^j Unacceptable conditions.

Appendix Table C.8. (p. 4 of 4)

Stream	1990 ^b	1991	1992 ^b	1993	1994 ⁱ	Aerial Escapement Goals
Noatak Drainage						
Noatak River below Kelly River	23,345 ^b	82,750	34,335	25,415		80,000
Eli River	3,000	2,940	701	4,795		
Kelly River & Lake	325 ⁱ	654	726	9		
Noatak River System Total	26,670	86,344	35,762	30,219		
Kobuk Drainage						
Kobuk to Pah River	4,610	9,840	1,030	3,896		
Pah River to just below Selby River	305	2,780	3,820	1,535		
Selby River mouth & Slough		1,040	1,500	1,800		
Selby River	420	1,460	868	824		
Selby R. mouth to just below Beaver C.	7,505	5,250	3,845	929		
Beaver Creek mouth						
Above Beaver Creek	2,515	4,155	740	3,174		
Upper Kobuk River Total	15,355	24,525	11,803	12,158		10,000
Squirrel River	5,500	4,606	2,765	4,463		11,500
Salmon River	6,335	5,845	1,345	13,880		7,000
Tutuksuk River	2,275	744	1,162	1,196		2,000
Kobuk River System Total	29,465	35,720	17,075	31,697		

^a Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indices listed in this table are the largest survey observed for each tributary during the given year.

^b Poor survey conditions or incomplete, early or late survey.

^c Survey by foot or boat.

^d These fish are unidentified salmon, mostly chums.

^e This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.

^f Unresolvable discrepancies in historical data put this figure in question.

^g Unclear where these fish were observed.

^h The figures in this table have been corrected and supercede figures in previous reports.

ⁱ Surveyed well before peak of migration.

^j Unacceptable conditions.

Appendix Table C.9. Kotzebue District commercial age and sex composition of chum salmon, 1962–1994.^a

Year	Sample Size	Percent		Percent Age Class			
		Males	Females	Age–3	Age–4	Age–5	Age–6
1962	69	26.1	73.9	7.3	63.3	28.0	1.4
1963	255	35.0	65.0	30.1	50.9	18.6	0.4
1964	463	43.6	56.4	52.9	45.0	1.7	0.4
1965	480	42.1	57.9	2.3	91.0	6.7	0.0
1966	430	40.2	59.8	10.1	67.1	22.8	0.0
1967	1,865	37.3	62.7	8.8	72.2	18.5	0.5
1968	1,989	48.2	51.8	21.2	58.1	19.8	0.9
1969	1,125	53.7	46.3	36.8	58.3	4.9	0.0
1970	267	45.3	54.7	3.9	91.0	5.1	0.0
1971	1,105	54.6	45.4	7.1	66.8	26.1	0.0
1972	980	50.9	49.1	15.8	59.5	24.1	0.6
1973	598	46.0	54.0	16.7	69.5	13.8	0.0
1974	350	47.1	52.9	28.5	63.5	7.8	0.2
1975	340	46.4	53.6	2.5	86.8	10.7	0.0
1976	566	47.9	52.1	11.2	51.5	37.2	0.1
1977	446	49.3	50.7	6.7	73.0	18.6	1.7
1978	579	49.9	50.1	10.5	57.5	31.8	0.2
1979 ^b	658	53.3	46.7	30.6	53.2	15.2	1.0
1980 ^c	710	56.4	43.6	15.1	78.1	6.6	0.2
1981 ^d	1,167	52.4	47.6	2.4	67.1	30.5	0.0
1982	983	48.8	51.2	5.9	48.3	40.3	5.5
1983 ^e	1,979	43.4	56.6	5.8	57.7	34.2	2.3
1984 ^f	2,933	50.2	49.8	14.6	64.4	19.7	1.3
1985 ^g	3,293	47.8	52.2	0.4	83.7	15.5	0.4
1986 ^h	3,095	46.0	54.0	0.3	18.6	78.9	2.2
1987 ⁱ	1,987	52.0	48.0	15.0	43.0	31.0	11.0
1988 ^j	3,324	48.0	52.0	6.5	74.9	16.9	1.7
1989	3,336	49.3	50.7	0.7	77.9	20.4	1.0
1990 ^k	2,497	49.4	50.6	2.3	45.6	50.7	1.4
1991	3,292	46.4	53.6	2.9	60.4	35.8	0.9
1992 ^l	3,706	39.9	60.1	0.9	58.5	37.5	3.1
1993 ^m	3,707	50.9	49.1	2.9	26.4	66.5	4.2
15 Year Average. (1979–1993)		47.8	52.2	4.9	56.6	36.2	2.4
1994 ⁿ	3,744	44.8	55.2	3.3	63.0	30.8	2.9

^a Commercial periods not sampled for years 1962 to 1978 are unknown.

^b Commercial openings 1 and 10 not sampled due to period closure.

^c Commercial openings 8, 13, and 15 not sampled due to period closure.

^d Commercial openings 8, 10, 12, and 14 not sampled due to period closure.

^e Commercial openings 11, 13, 14, and 15 not sampled due to period closure.

^f Commercial openings 14 and 15 not sampled due to period closure.

^g Commercial openings 1, 3, 5, 7, 9, 11, and 13 not sampled due to period closure.

^h Commercial opening 15 not sampled due to period closure.

ⁱ Commercial openings 1, 2, 4, 6, 7, 8, 10, 11, 14, and 15 not sampled due to period closure.

^j Includes 0.1 percent age–7 fish.

^k Commercial openings 11 to 15 not sampled due to period closure.

^l Commercial opening 12 not sampled due to period closure.

^m Commercial openings 6, 8, 10, 11, 12, 13, 14, and 15 were closed periods. Closed periods were sampled for age and sex composition from commercial test nets and are included in the 1993 data.

ⁿ The normal commercial openings of 14, and 15 were closed periods because of no buyers. These periods were sampled for age and sex composition from commercial test nets and are included in the 1994 data.

(Includes Norton Sound and Port Clarence/Kotzebue Districts)

SECTION 2 - PACIFIC HERRING

INTRODUCTION

Boundaries

The Norton Sound District consists of all waters of Alaska between the latitude of the western most tip of Cape Douglas and the latitude of Canal Point Light (Figures 8 and 9). The Port Clarence District consists of all waters of Alaska between the latitude of Cape Douglas and the latitude of Cape Prince of Wales. The Kotzebue District consists of all waters of Alaska between the latitude of Cape Prince of Wales and the latitude of Point Hope (Figure 8).

Spawning Areas and Timing

The arrival of Pacific herring on the spawning grounds is greatly influenced by climate and oceanic conditions, particularly the extent and distribution of the Bering Sea ice pack. Most herring spawning populations appear near the eastern Bering Sea coast immediately after ice breakup between mid-May and mid-June. Spawning progresses in a northerly direction and may continue into July or August along portions of the Seward Peninsula or within the Chukchi Sea.

The primary spawning areas within Norton Sound have been from Stuart Island to Tolstoi Point. When sea ice has remained in this area into June, spawning has been more extensive along Cape Denbigh and several locations along the northern shore of Norton Sound between Bald Head and Bluff. More northerly spawning areas have been more difficult to identify due to small herring stock sizes and limited investigations. Likely spawning areas include Imuruk Basin, Shishmaref, Deering-Kiwalik, and Hotham Inlet.

NORTON SOUND DISTRICT

Fishing History

Pacific herring (Clupea harengus pallasii) have been utilized for subsistence purposes by coastal residents prior to the mid-1800's when their use was first documented by early explorers. The earliest American commercial effort on Bering Sea herring apparently took place in the early part of this century at Golovin Bay in Norton Sound (Appendix Table D1).

Food Herring

Early records indicate that about 3,200 short tons of "fall herring" were processed in Norton Sound from 1916 to 1941 (Appendix Table D1). This fishery was dependent on salt curing and declined because of poor marketing conditions arising from foreign competition. The Japanese began gillnetting in Norton Sound during 1968 with three vessels. Effort was concentrated about 12 miles offshore between St. Michael and Golovin. Approximately 40 Japanese vessels reported harvesting a record 1,400 short tons (st) of herring during 1969 (Appendix Table D2). An average annual harvest of approximately 440 st was reported in Norton Sound by the Japanese during 1968-1974. The Japanese gillnet fishery was prohibited in 1977.

Sac Roe

Domestic commercial effort resumed in Norton Sound in 1964 near Unalakleet and continued on a sporadic basis until 1979. Between 1964 and 1978 the fishery averaged about 14 short tons of herring annually and targeted on "spring herring" for sac roe extraction (Appendix Table D1). In 1979, a domestic herring fishery for sac roe began on a larger scale in Norton Sound when approximately 1,292 short tons (st) of herring were taken by 63 fishermen (13 purse seiners, 50 gillnetters). Purse seiners took 70% of the total catch.

After the 1979 season, the Alaska Board of Fisheries adopted a public proposal which made gillnets and beach seines the only legal commercial herring fishing gear within Norton Sound. A purse seine fishery could only be opened if the gillnet fleet could not take the allowable harvest. This regulation was an attempt to encourage involvement of local fishermen in this developing fishery. During the 1980 season, 294 gillnet fishermen harvested 2,452 short tons of herring (Appendix Table D3). Because gillnet fishermen demonstrated that they were capable of taking the available harvest, a regulation was passed in 1981 which prohibited any purse seine gear within Norton Sound.

Prior to the 1984 season, the harvest by beach seine fishermen was negligible. During 1984, ten beach seine fishermen harvested 327 st. During their 1984 fall meeting, the Board of Fisheries set a beach seine gear limit of 100 fathoms and limited the harvest to "not exceed 10 percent of the total herring sac roe harvest projection as published by the department." During the fall 1987 Board of Fisheries meetings, beach seine gear was further restricted to a limit of 75 fathoms. Beach seine harvests since 1985 have averaged 6.3% of the total reported harvest.

As with any developing fishery, fishing effort increased with each successive season. In 1984 Norton Sound became a Super-Exclusive Use herring fishing district in order to slow growth and bolster local involvement, but with only limited success. The 1987 season had the highest level of fishing effort on record with a total of 564 fishermen making at least one delivery, where 559 gillnet and 22 beach seine permits recorded landings. This was more than twice the average effort from 1980 through 1986. Local Norton Sound area residents accounted for 36% of the effort and 29% of the total harvest.

SECTION 2 - PACIFIC HERRING

INTRODUCTION

Boundaries

The Norton Sound District consists of all waters of Alaska between the latitude of the western most tip of Cape Douglas and the latitude of Canal Point Light (Figures 8 and 9). The Port Clarence District consists of all waters of Alaska between the latitude of Cape Douglas and the latitude of Cape Prince of Wales. The Kotzebue District consists of all waters of Alaska between the latitude of Cape Prince of Wales and the latitude of Point Hope (Figure 8).

Spawning Areas and Timing

The arrival of Pacific herring on the spawning grounds is greatly influenced by climate and oceanic conditions, particularly the extent and distribution of the Bering Sea ice pack. Most herring spawning populations appear near the eastern Bering Sea coast immediately after ice breakup between mid-May and mid-June. Spawning progresses in a northerly direction and may continue into July or August along portions of the Seward Peninsula or within the Chukchi Sea.

The primary spawning areas within Norton Sound have been from Stuart Island to Tolstoi Point. When sea ice has remained in this area into June, spawning has been more extensive along Cape Denbigh and several locations along the northern shore of Norton Sound between Bald Head and Bluff. More northerly spawning areas have been more difficult to identify due to small herring stock sizes and limited investigations. Likely spawning areas include Imuruk Basin, Shishmaref, Deering-Kiwalik, and Hotham Inlet.

NORTON SOUND DISTRICT

Fishing History

Pacific herring (*Clupea harengus pallasii*) have been utilized for subsistence purposes by coastal residents prior to the mid-1800's when their use was first documented by early explorers. The earliest American commercial effort on Bering Sea herring apparently took place in the early part of this century at Golovin Bay in Norton Sound (Appendix Table D1).

Food Herring

Early records indicate that about 3,200 short tons of "fall herring" were processed in Norton Sound from 1916 to 1941 (Appendix Table D1). This fishery was dependent on salt curing and declined because of poor marketing conditions arising from foreign competition. The Japanese began gillnetting in Norton Sound during 1968 with three vessels. Effort was concentrated about 12 miles offshore between St. Michael and Golovin. Approximately 40 Japanese vessels reported harvesting a record 1,400 short tons (st) of herring during 1969 (Appendix Table D2). An average annual harvest of approximately 440 st was reported in Norton Sound by the Japanese during 1968-1974. The Japanese gillnet fishery was prohibited in 1977.

Sac Roe

Domestic commercial effort resumed in Norton Sound in 1964 near Unalakleet and continued on a sporadic basis until 1979. Between 1964 and 1978 the fishery averaged about 14 short tons of herring annually and targeted on "spring herring" for sac roe extraction (Appendix Table D1). In 1979, a domestic herring fishery for sac roe began on a larger scale in Norton Sound when approximately 1,292 short tons (st) of herring were taken by 63 fishermen (13 purse seiners, 50 gillnetters). Purse seiners took 70% of the total catch.

After the 1979 season, the Alaska Board of Fisheries adopted a public proposal which made gillnets and beach seines the only legal commercial herring fishing gear within Norton Sound. A purse seine fishery could only be opened if the gillnet fleet could not take the allowable harvest. This regulation was an attempt to encourage involvement of local fishermen in this developing fishery. During the 1980 season, 294 gillnet fishermen harvested 2,452 short tons of herring (Appendix Table D3). Because gillnet fishermen demonstrated that they were capable of taking the available harvest, a regulation was passed in 1981 which prohibited any purse seine gear within Norton Sound.

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As with any developing fishery, fishing effort increased with each successive season. In 1984 Norton Sound became a Super-Exclusive Use herring fishing district in order to slow growth and bolster local involvement, but with only limited success. The 1987 season had the highest level of fishing effort on record with a total of 564 fishermen making at least one delivery, where 559 gillnet and 22 beach seine permits recorded landings. This was more than twice the average effort from 1980 through 1986. Local Norton Sound area residents accounted for 36% of the effort and 29% of the total harvest.

A public proposal to the Fall 1987 Board of Fish was adopted that changed the Norton Sound Herring Fishing District to Limited Entry status. Beginning with the 1988 season, a moratorium was placed on Norton Sound where no new entrants were allowed into the fishery. The Limited Entry Commission is reviewing and awarding limited entry permits to fishermen based on fishing history and will eventually reduce the total number to 301 gillnet and 4 beach seine permits as directed by the Board of Fish. Currently, some fishermen have already received limited entry permits and others are still fishing with interim-use permits while their eligibility is being evaluated on a case-by-case basis.

Commercial harvests from 1981-1984 averaged 4,137 st, and ranged from a low of 3,662 st in 1984 to 4,582 st in 1983 (Appendix Table D3). From 1985-1988, commercial herring harvests have averaged 4,374 st, ranging from a low of 3,548 st in 1985 to a high of 5,194 st in 1986. And most recently, from 1989-1991, harvests have averaged 5,596 st, ranging from 4,743 st in 1989 to 6,373 st in 1990. Level of commercial harvest is influenced by stock status, product value and climatic factors.

Spawn on Kelp

A small scale spawn-on-kelp (*Fucus*) fishery existed in Norton Sound from 1977 to 1984. Harvests during the 1977-1984 period ranged from less than one ton (1977) to approximately 46 st (1981). In addition, during the 1984 season, one ton of macrocystus kelp was imported into Norton Sound resulting in a harvest of approximately 3 st of product. In response to a public proposal, a Board of Fisheries action prior to the 1985 season resulted in the closure of all spawn-on-kelp fisheries in Norton Sound (Appendix Table D5).

Management Strategies

The overall statewide management strategy is to annually harvest 0-20% of the herring biomass. The upper end of the exploitation range is applied to stocks in good condition. The lower end of the exploitation range is applied to stocks that are exhibiting a trend of decreasing abundance and poor recruitment. If a minimum threshold level is not achieved, 7,000st for Norton Sound, no commercial fishery will be allowed.

Typically herring are long lived fish and will usually remain harvestable for at least 5 years after recruiting into the fishery. Harvesting only a percentage of the biomass ensures that some fish will be held over for following years. This type of strategy helps mitigate population fluctuations caused by successive years of poor recruitment, a common occurrence in marine spawning fish. Prior to 1983, harvests in Norton Sound were regulated on a subdistrict basis so harvests would be dispersed over the entire fishing grounds. This was to prevent harvest efforts from concentrating in one area on what was then thought to be a distinct stock of fish.

Since methods to reliably forecast herring returns are still being developed and estimates of recruitment are not available, in-season assessments of biomass supersede the projected biomass for management of the Norton Sound herring fishery. The herring biomass will be managed for a 20% exploitation rate if the in-season aerial biomass surveys and age class composition information indicate the run will achieve at least the preseason biomass projection. If the run does not materialize as projected, the harvest exploitation rate may be reduced to a lower level.

Generally, the fisheries management staff has tried to set fisheries openings to allow gillnetters to fish the flood tide as it crests. The belief that the ripe females approach the beach at that time to spawn figures heavily in that strategy. The Norton Sound fishery covers a large area with varying tides. Because the large gillnet fleet can not "fit" into individual subdistricts, opening at the optimal time throughout the district is not always possible. The fishing fleet must be flexible to maximize catches.

The beach seine openings are dependent on herring abundance near the beach and favorable weather conditions for spotters and fishing. Beach seiners prefer to work flood tides similar to those gillnetters favor, however, fisheries managers frequently provide less optimal fishing times. The beach seiners have shown the ability to harvest their allotment of 10% of the preseason harvest goal in a single three hour opening under ideal conditions. By the nature of the gear, beach seiners have the potential to wrap up large numbers of fish which could potentially exceed their allocation. Therefore, the management staff have often chosen to reduce the beach seine efficiency by allowing a gillnet opening to occur before the beach seine opening in order to break up school size and reduce the likelihood of a bonanza. Occasionally, the beach seine fleet has been used to test the roe quality of herring newly arrived in nearshore waters prior to a gillnet opening where the potential for waste would have been great had the entire gillnet fleet fished on poor quality herring.

1994 SEASON SUMMARY

The 1994 Norton Sound herring fishery opened by emergency order on June 5. A total of four gill net openings occurred for 24 hours of fishing and one co-oped beach seine opening totalling 54 hours. No educational openings were allowed this year. Subdistricts 1 through 5 were closed by news release on June 9. The total harvest based on fish ticket data was 960.4 short tons (st) of herring (Table 1). Since 1981, catches have averaged 4,074 st (Table 2).

There were 215 fishermen who made at least one delivery during the season. This is the lowest effort since 1984, excluding 1992 when there was no fishery. Fishing effort had been declining in recent years as limited entry was put into effect, this season's low effort was in part due to the poor price projected prior to the season, last year's closed season and the drawn out nature of the season.

During the 1994 season, 212 fishermen used gill nets, landing a total of 918.3 st. The average sac roe recovery for gill net caught herring was 10.3%. Five fishermen participated in the beach seine

fishery, but only three made deliveries, landing 39.7 st of herring. The average sac roe recovery for beach seine caught herring was 9.4% (Table 3). An effort was made to separate beach seiners from the gill net fleet to prevent gear conflicts and to enable the Department to better monitor the beach seine fishery. The location of the beach seine fishery utilized different beaches than the gill net fishery and was under the direct supervision of a biologist.

There were seven companies present on the grounds during the season to purchase herring. Two of these companies combined to report as one during the fishery. These 6 companies registered 11 processors and 46 tenders totaling 57 vessels (Table 4).

The average sac roe recovery for all gear types was 10.3%. The combined sac roe and bait roe percentage was the same roe due to the tiny 2.5 st bait harvest. Based on final operations reports, it appears the average price advanced for a short ton of 10% roe herring was approximately \$295.00. The average price paid to the fishermen for a short ton of 10.3% fish was approximately \$303.52. Of the 960.4 st harvested, 2.5 st were purchased as bait herring (roe % less than 7.0%) for which fishermen received an average of \$50.00 per ton. The total value of the herring harvest to the fishermen was approximately \$270,803.68.

Conditions for aerial observation of herring biomass were generally fair to poor for the season (Table 5). The commercial fishery was managed using the preseason biomass projection, since the peak aerial survey did not occur until June 11. The peak aerial survey of 36,869 combined with estimated season's harvest approximated the projected biomass. The preseason guideline harvest was 7,821 st, with 7,039 st allocated to the gill net fishery and 782 st allocated to the beach seine fishery. During the fishery, it was assumed the projected biomass was present and that the preseason guideline harvest could be harvested. The 1994 biomass, including the harvest is estimated to be 37,829 st. The final harvest, 960.4 st gives an exploitation rate of 2.5 percent.

The aerial survey of June 11 verified the preseason projection. The survey schedule was continued through June 14, when the aerial survey fund was nearly exhausted. Pilots and fishermen reported significant herring biomass present in Norton Sound for several more days.

Fishery Management/Emergency Orders

The Norton Sound Herring Management Plan¹ stated that the Department would attempt to manage the fishery for marketable roe recovery. During 1994, industry standards called for 9.0% roe, as opposed to the Department standard of 8.5% in past years. Several companies set their standards at 10.0%, after the highly successful Togiak fishery. State of Alaska statutes direct that the resource should be managed so as to maximize the return to the State and the industry. The result

¹ Alaska Department of Fish and Game. May 1994. 1994 Herring Fisheries Management Plan. Regional Information Report No. 3A94-17. 8pp. Anchorage, Alaska.

of this higher standard was a decrease in the number of openings that could reasonably be expected to meet the quality standard.

The 1994 Norton Sound Herring Management Plan also stated a projected biomass of 39,108 st was expected to return this season. This projected return was based upon the 1993 escapement estimate, using a schedule of increasing natural mortality with age. The 1994 spawning biomass was expected to be dominated by age 6, 8, and 12 year old herring. If aerial survey observations and age class composition indicated a return of 39,103 st, then 20% or 7,821 st (7,039 st by gill nets, 782 st by beach seines) could be harvested.

Aerial survey conditions were fair to poor during the 1994 season (Table 5). The first survey was flown May 17. Sea ice cleared from Norton Sound early this season. Very few ice floes existed from Wood Point to Point Dexter by May 25. Only Norton Bay and Golovin Bay held much ice along the Northern shore of Norton Sound at that time. May 25 marks the first aerial sightings of herring; although, the first herring were caught in the test nets May 23.

The biomass gradually increased, with the first spawn being reported on May 31. The fishing fleet was put on two hour notice effective 11:00 a.m. June 1. Even though spawn was observed June 1, the total biomass remained less than 1,000 tons, which samples indicated to be predominantly male. Older aged herring composed the bulk of the biomass observed near shore through June 1. On June 2, Roe quality at St. Michael was good near shore, but quantity was low, less than a 1,000 tons for the entire subdistrict. At the Cape Denbigh Subdistrict, roe quality was dropping due to younger immature fish coming into nearshore waters. The biomass built very gradually from June 3 to June 5, with herring being sighted in all the subdistricts.

By June 4, over half the biomass was in the Elim Subdistrict. An opening in Subdistrict 5 on June 6 produced little harvest because of low roe quality found in the immature herring. With the biomass still gradually building and roe tests indicating acceptable quality Subdistricts 1, 2, 3 and 5 were opened June 7. The biomass had tripled in the St. Michael area from two days earlier. Fishing was slow in all locations with high roe quality reported in the southern three subdistricts.

For the next three days, the biomass estimates remained stable while the age composition shifted from predominantly older (7 years and older) herring to a younger and smaller range of age classes (age 8 or younger). On June 8, several buyers and fishermen began questioning the harvest of these younger age classes. Their concern was that the gillnets were not holding many small fish but were potentially injuring a significant portion of the biomass. On June 9, the department staff also became concerned that the impact on the smaller herring was causing mortality with a minimal harvest. Consequently, Subdistricts 1 through 5 were closed effective 6:00 p.m. June 9.

The peak aerial survey was flown two days later on June 11, when nearly 37,000 tons of herring were estimated to be primarily along the northern shores of Norton Sound. The last survey of eastern Norton Sound was flown June 14. The herring in nearshore waters were declining with the largest concentrations in Subdistricts 5 and 7.

The 1994 herring fishery is one of the least successful seasons recorded in Norton Sound. The 1994 herring migration was expected to be early with the early break-up of the sea ice. Although the waters of Norton Sound were quite warm, ice conditions in the central Bering Sea were late and formed a thermal barrier to the herring migration. Only a narrow corridor of greater than zero degree Celsius water connected the warm waters of Norton Sound to the warmer waters south of Nunivak Island during late May and early June.

This unusual temperature barrier slowed herring entry into Norton Sound. When the herring encountered the warm waters of Norton Sound they quickly ripened and began to spawn. Because the large older age herring (9+), the commercially important portion of the migration, was spread from May 31 to June 8, a "scratch fishery" scenario was the only option for the management of the fishery. Because the typical entry pattern for herring often involves some light spawn prior to the peak of the fishery, the Department staff did not immediately realize the implications for the 1994 fishery. This situation was further compounded by several buyers' strict quality standards and problems of conducting a low volume fishery with the largest herring gillnet fleet in the largest district in the state. The end result was a disappointing fishery with many fishermen and some buyers reconsidering their future in this fishery.

Catch Reporting and Enforcement

Buyers registered for the 1994 season were required to report herring purchases daily (8:30 a.m.) and three hours following the closure of each period. As in past years, due to the scheduling of successive openings by gear type, clean-up catch reports were requested as soon as catch figures could become available. In general, compliance with requested catch reports was very good. The VHF radio turned out to be the communication equipment of choice due to the range of the SSB radio equipment. Communications with the field camps was accomplished with marine VHF, SSB or by aircraft radio from the aerial survey plane.

Protection efforts in Norton Sound consisted of five single engine aircraft (three super cubs on wheels, a helicopter and a C-185 on wheels) and a small boat. Personnel consisted of 5 permanent, full-time and one seasonal Fish and Wildlife Protection officers.

Fish and Wildlife Protection officers patrolled the grounds during each opening and closure. One citation was issued for no photo ID. No herring were confiscated by the State of Alaska during the 1994 season. The slow pace and low volume of the 1994 fishery allowed most people ample time to make appropriate decisions regarding their participation in the fishery.

Abundance and Research

Two Department field crews were operational during the 1994 season. One crew operated from Cape Denbigh and the second crew operated from Klikitarik. The test fish crews presence and

sampling efforts on the herring grounds are critical to the proper management of the fishery and biological documentation of the stocks.

Unalakleet field office personnel during the season consisted of the area management biologist, the Norton Sound and Kotzebue assistant area management biologists, the catch monitor/public receptionist. In addition, a fisheries technician was hired to fulfill the commercial sampling requirements. The regional herring biometrician was present to provide overall quality control of herring sampling and assistance with sample collection and procedures, as was the regional supervisor, and regional management biologist whom assisted the staff in nearly every facet of the operation.

At the time of this report preparation, field data and herring scales collected during the season are being analyzed. The data will be formalized and presented in separate project and management reports later this season.

Table 15. Daily observed peak biomass estimates of Pacific herring, Norton Sound District, 1994

Date	Flight No.	Observer Initials	Survey		Spawn		Estimated Biomass (ST) By Index Area							
			Hrs	Rating	No.	Lng (mi)	KLK	UNK	CDB	NTB	ELM	GOL	NOM	TOTAL
5/17	1	FB	1.9	ice	0	0.0	-	0.0	0.0	0.0	0.0	0.0	-	0.0
5/20	2A	CL	1.5	3.0	0	0.0	-	0.0	0.0	-	-	-	-	0.0
5/20	2B	TL	3.0	3.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/21	3A	CL	2.5	4.0	0	0.0	0.0	0.0	0.0	-	-	-	-	0.0
5/21	3B	TL	4.0	4.0	0	0.0	0.0	0.0	0.0	-	-	-	-	0.0
5/23	4A	CL	2.3	4.0	0	0.0	0.0	0.0	0.0	-	-	-	-	0.0
5/23	4B	TL	4.0	4.0	0	0.0	0.0	0.0	0.0	-	-	-	-	0.0
5/25	5A	FB	1.8	3.0	0	0.0	-	0.0	18.1	0.0	0.0	-	-	18.1
5/25	5B	TL	3.0	3.0	0	0.0	-	0.0	18.1	0.0	0.0	-	-	18.1
5/26	6	CL&FB	2.9	2.0	0	0.0	-	0.0	111.4	-	-	-	-	111.4
5/27	7	CL&TL	3.2	3.0	0	0.0	0.0	0.0	316.8	0.0	0.0	-	-	316.8
5/28	8	CL&TL	1.3	4.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/29	9a	FB	1.4	2.0	0	0.0	ice	0.0	69.7	-	-	-	-	69.7
5/29	9b	CL	2.0	2.0	0	0.0	ice	0.0	72.9	-	-	-	-	72.9
5/30	10	CL&TL	3.5	4.0	0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	0.0
5/31	11a	FB	2.4	4.0	69	2.4	49.2	89.2	657.4	-	-	-	-	795.8
5/31	11b	TL	3.0	3.0	54	1.9	41.3	88.5	362.7	-	-	-	-	492.5
5/31	12	FB	1.6	3.5	83	3.5	216.2	0.0	-	-	-	-	-	216.2
6/1	13a	CL	4.2	3.0	51	2.3	112.7	0.0	322.5	94.5	212.0	76.6	-	818.3
6/1	13b	FB	3.0	3.0	83	2.6	66.9	0.0	415.8	49.5	226.0	86.4	-	844.6
6/2	14A	CL	3.1	4.0	50	1.6	1,076.2	129.0	749.1	-	-	-	-	1,954.3
6/2	14B	TL	3.0	3.0	61	1.4	929.0	105.8	883.7	-	-	-	-	1,918.5
6/2	15A	CL	5.0	4.0	44	2.2	19.8	0.0	-	-	-	-	-	19.8
6/2	15B	TL	2.0	4.0	64	1.7	137.2	0.0	-	-	-	-	-	137.2
6/3	16A	FB	3.1	3.0	15.0	0.8	562.5	0.0	464.9	83.0	476.7	319.0	103.2	2,009.3
6/3	16B	TL	3.0	3.0	15	0.3	106.8	0.0	308.2	166.6	207.0	359.8	98.0	1,246.4
6/4	17A	CL	3.5	5.0	45	1.6	1,869.9	162.0	446.3	0.0	3,204.7	639.8	-	6,322.7
6/4	17B	FB	4.0	4.0	-	-	2,275.9	76.9	243.4	0.0	2,619.4	647.1	-	5,862.7
6/4	18A	CL	1.5	5.0	36	2.1	2,550.1	0.0	-	-	-	-	-	2,550.1
6/4	18B	FB	5.0	5.0	56	2.3	2,619.1	0.0	-	-	-	-	-	2,619.1
6/5	19A	CL	3.8	4.0	65	3.5	2,656.5	276.2	263.5	182.1	4,571.9	939.2	-	8,889.4
6/5	19B	TL	3.0	3.0	139	3.3	3,967.5	353.9	242.0	157.4	2,931.7	1,766.2	-	9,418.7
6/5	20A	CL	1.1	5.0	20	1.1	628.5	156.8	-	-	-	-	-	785.3
6/5	20B	TL	4.0	4.0	20	0.7	1,035.6	300.6	-	-	-	-	-	1,336.2
6/6	21A	FB	4.6	3.0	54	1.6	6,777.4	329.8	2,014.7	28.3	1,583.8	1,820.3	1,076.0	13,630.3
6/6	21B	TL	3.0	3.0	39	1.6	6,291.1	581.1	2,807.8	224.6	2,066.9	3,259.2	2,750.4	17,980.9
6/7	22X	CL&FB	4.6	3.0	86	6.8	11,372.0	2,807.0	2,730.0	70.0	1,541.0	1,809.0	1,901.0	22,230.0
6/8	23A	CL	2.6	3.0	22	0.6	7,629.4	1,738.6	6,870.2	-	-	-	-	16,238.2
6/8	23B	TL	4.0	4.0	11	0.2	5,494.4	568.5	3,280.6	-	-	-	-	9,343.5
6/9	24A	FB	4.8	4.0	29.0	1.6	8,252.7	117.0	2,007.1	56.5	799.5	3,309.5	2,020.4	16,562.7
6/9	24B	TL	3.0	3.0	27	1.6	5,190.4	485.0	2,497.4	43.0	1,526.8	4,214.8	2,192.1	16,149.5
6/11	25	CL	5.5	4.0	7.0	0.4	2,507.5	482.1	10,630.7	7,431.7	6,263.2	6,689.2	2,864.6	36,869.0
6/14	26	FB	5.0	5.0	4.0	0.2	-	0.0	169.7	0.0	8,944.6	1,060.0	2,571.2	12,745.5
6/16	27	CL	2.3	3.0	0.0	0.0	-	-	-	-	-	-	-	18.2
6/17	28	CL	2.0	5.0	0.0	0.0	-	-	-	-	-	-	-	0.0
6/20	29.0	CL	4.2	3.0	3.0	0.1	-	-	-	-	15.5	4,799.8	8,147.2	12,962.5
			84.2	3.5	1,252.0	50.0	Waste	0.0	Har. @ 6/11	960.4	Harvest	960.4	Ttl. Harvest	960.4
							2,507.5	482.1	10,630.7	7,431.7	6,263.2	9,553.8	Survey	36,869.0
													Biomass	37,629.4
													Exploit%	2.5%

* Surveyed only from Nome westward.

Survey Rating: 1=excellent
 2=good
 3=fair
 4=poor
 5=unacceptable

Index Areas: KLK=s.d.1
 UNK=s.d.
 CDB=s.d.
 NTB=s.d.4

ELM=s.d.5
 GOL=s.d.6
 NOM=s.d.7

Table 16. Norton Sound herring spawn estimates by subdistrict (s.d.), 1994.

Date	s.d. 1		s.d. 2		s.d. 3		s.d. 4		s.d. 5		s.d. 6		s.d. 7		Totals	
	#	Miles	#	Miles	#	Miles	#	Miles	#	Miles	#	Miles	#	Miles	#	Miles
5/17	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/20	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/21	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/23	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/25	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/26	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/27	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/29	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/30	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/31	69	2.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	69	2.4
5/31	83	3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	83	3.5
6/1	49	2.3	0	0.0	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	51	2.3
6/2	50	1.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	50	1.6
6/2	44	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	44	2.2
6/3	15	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	15	0.8
6/4	45	1.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	45	1.6
6/4	36	2.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	36	2.1
6/5	63	3.5	0	0.0	2	0.1	0	0.0	0	0.0	0	0.0	0	0.0	65	3.6
6/5	20	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	20	1.1
6/6	45	1.6	0	0.0	7	0.2	0	0.0	0	0.0	0	0.0	2	0.0	54	1.8
6/7	59	4.9	18	1.2	0	0.0	0	0.0	0	0.0	9	0.7	0	0.0	86	6.8
6/8	20	0.3	0	0.0	2	0.4	0	0.0	0	0.0	0	0.0	0	0.0	22	0.7
6/9	9	0.1	0	0.0	0	0.0	0	0.0	10	0.9	10	0.6	0	0.0	29	1.6
6/11	3	0.3	0	0.0	4	0.1	0	0.0	0	0.0	0	0.0	0	0.0	7	0.4
6/14	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	4	0.2	0	0.0	4	0.2
6/16	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6/17	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6/20	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.1	3	0.1
Totals	610	28.3	18	1.2	17	0.8	0	0	10	0.9	23	1.5	5	0.1	683	32.8

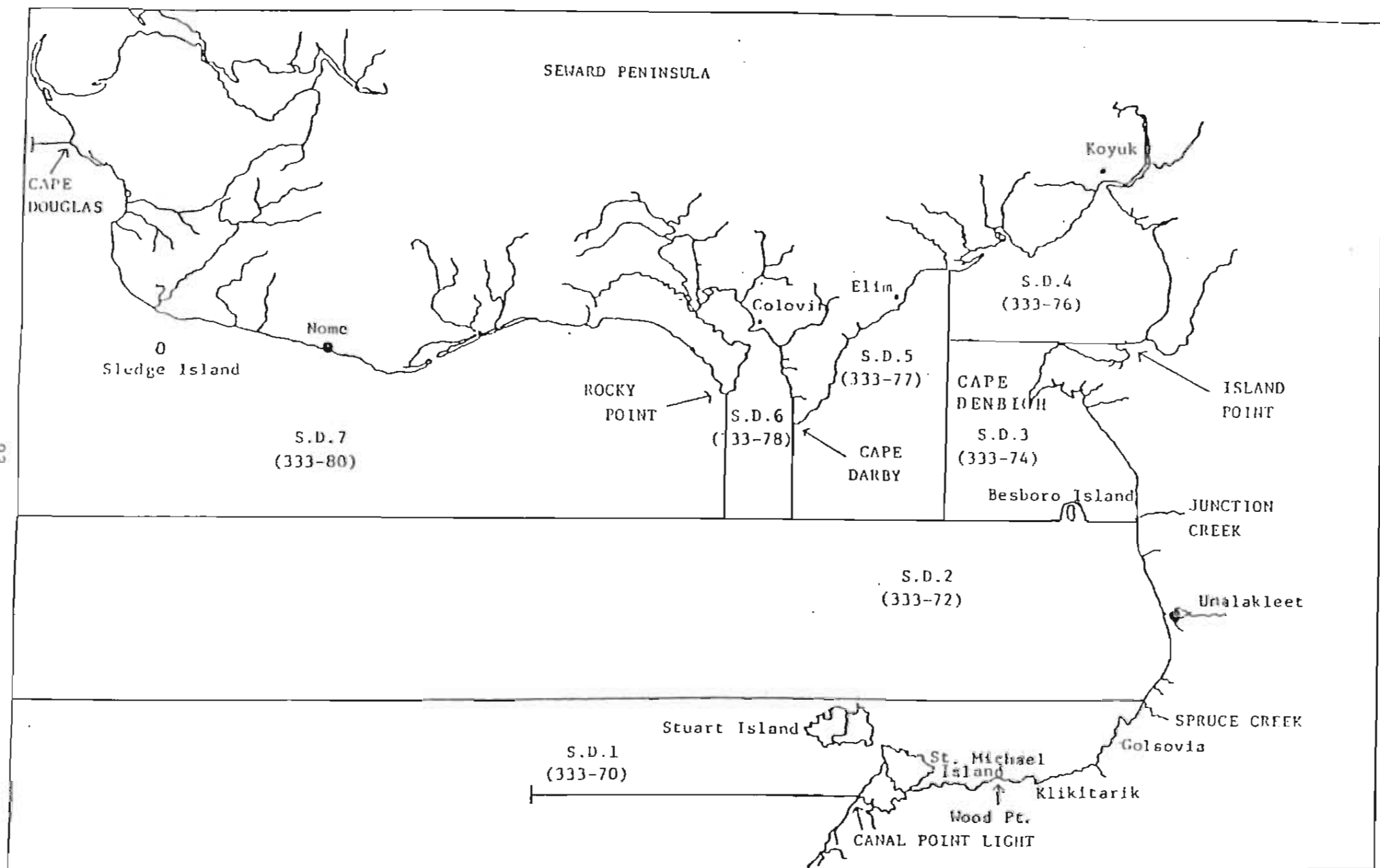


Figure 11. Norton Sound commercial herring district (333) and statistical boundaries.

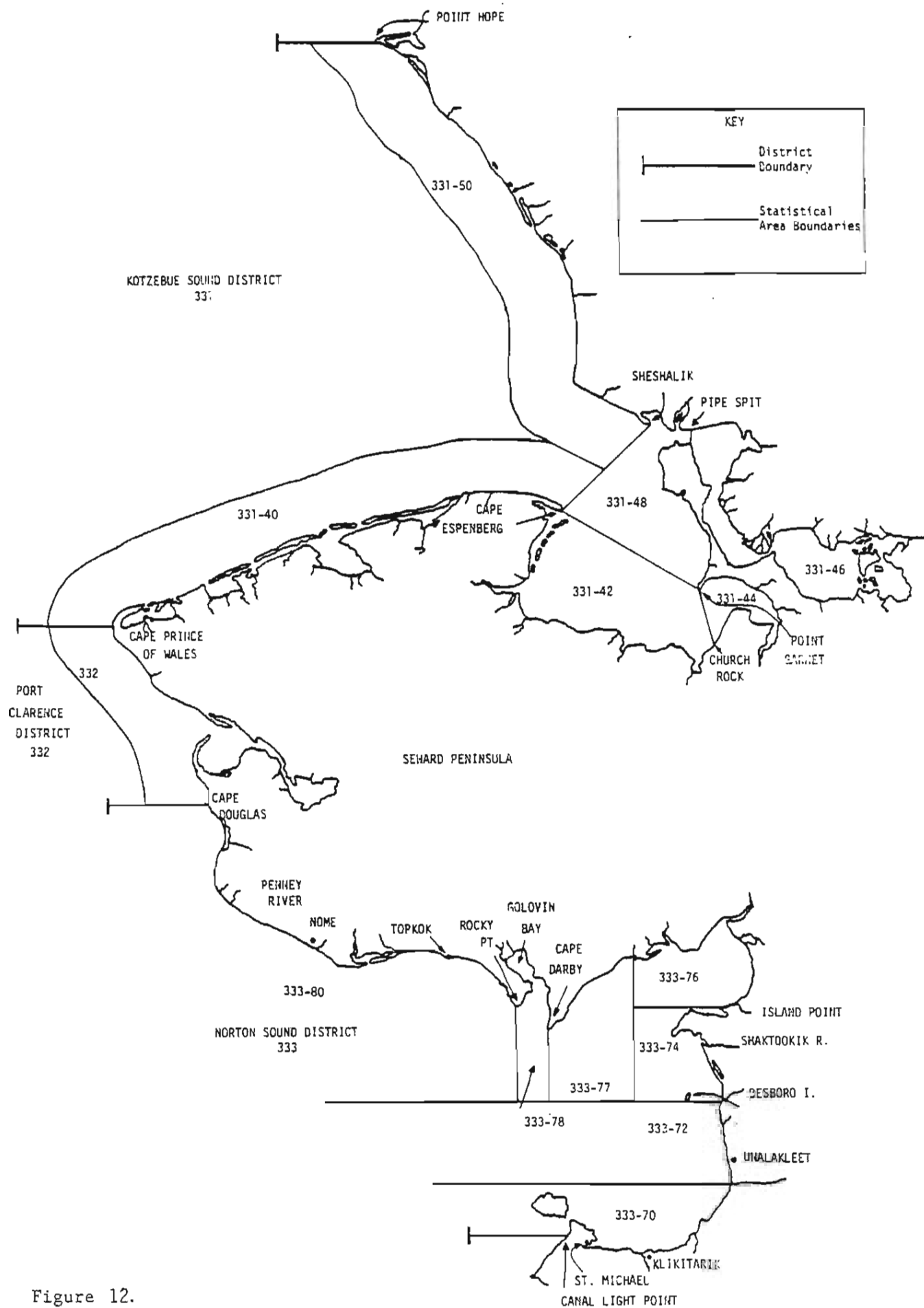


Figure 12.
Statistical areas of the Norton Sound, Port Clarence and Kotzebue commercial herring fishery districts.

Norton Sound District Age Composition of Commercial Gear Combined

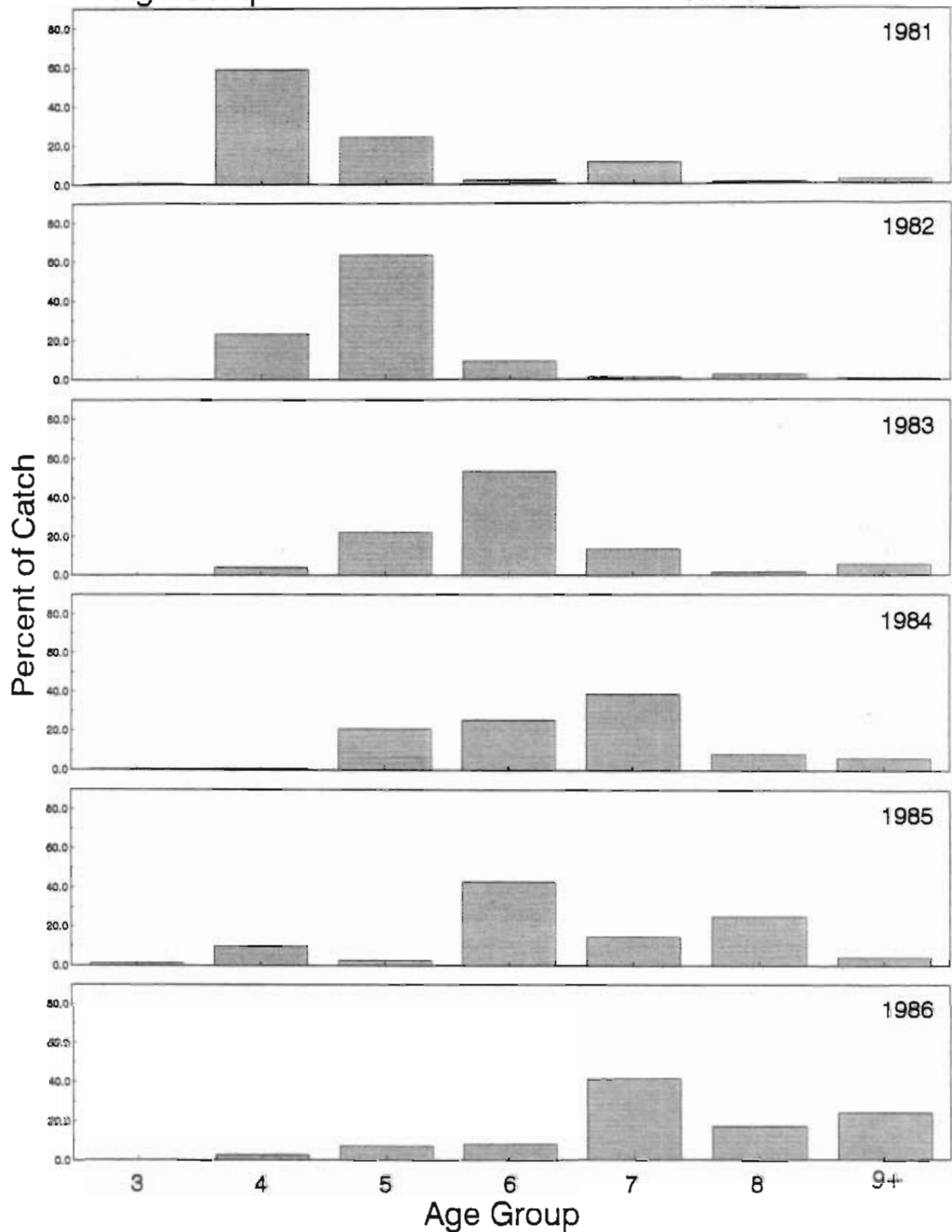


Figure 13. Norton Sound herring age class composition by percentage of commercial catch, commercial gear combined (beach seine and gill nets), 1981-1994. No commercial fishing occurred in 1992.

Norton Sound District Age Composition of Commercial Gear Combined

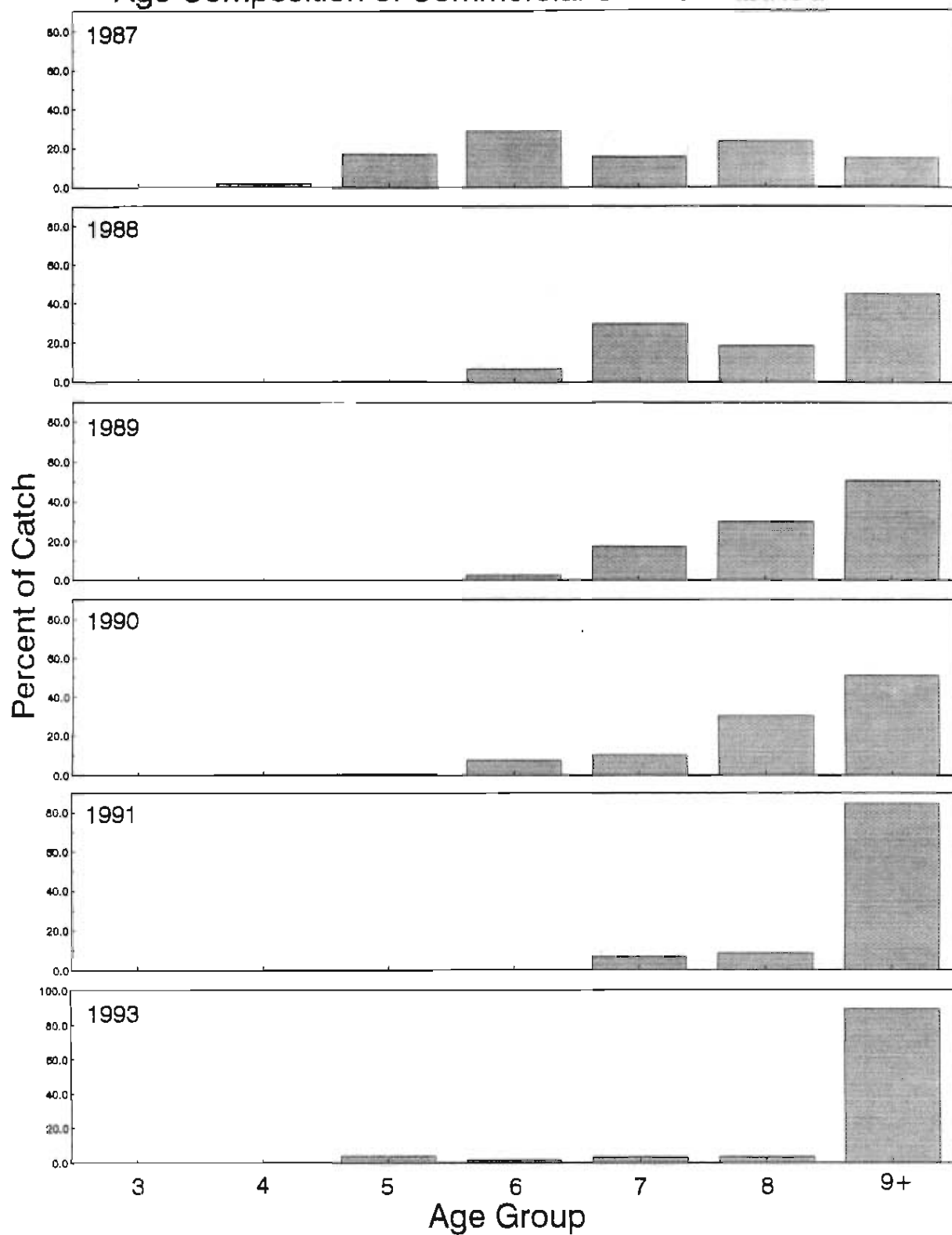


Figure 13. (page 2 of 3)

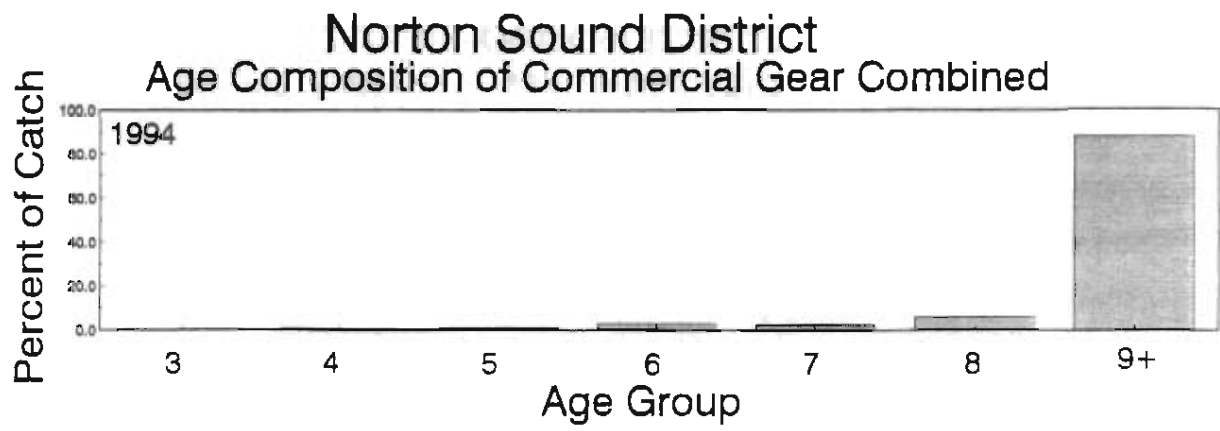


Figure 13. (page 3 of 3)

Norton Sound District Age Composition of Variable Mesh Gill Nets

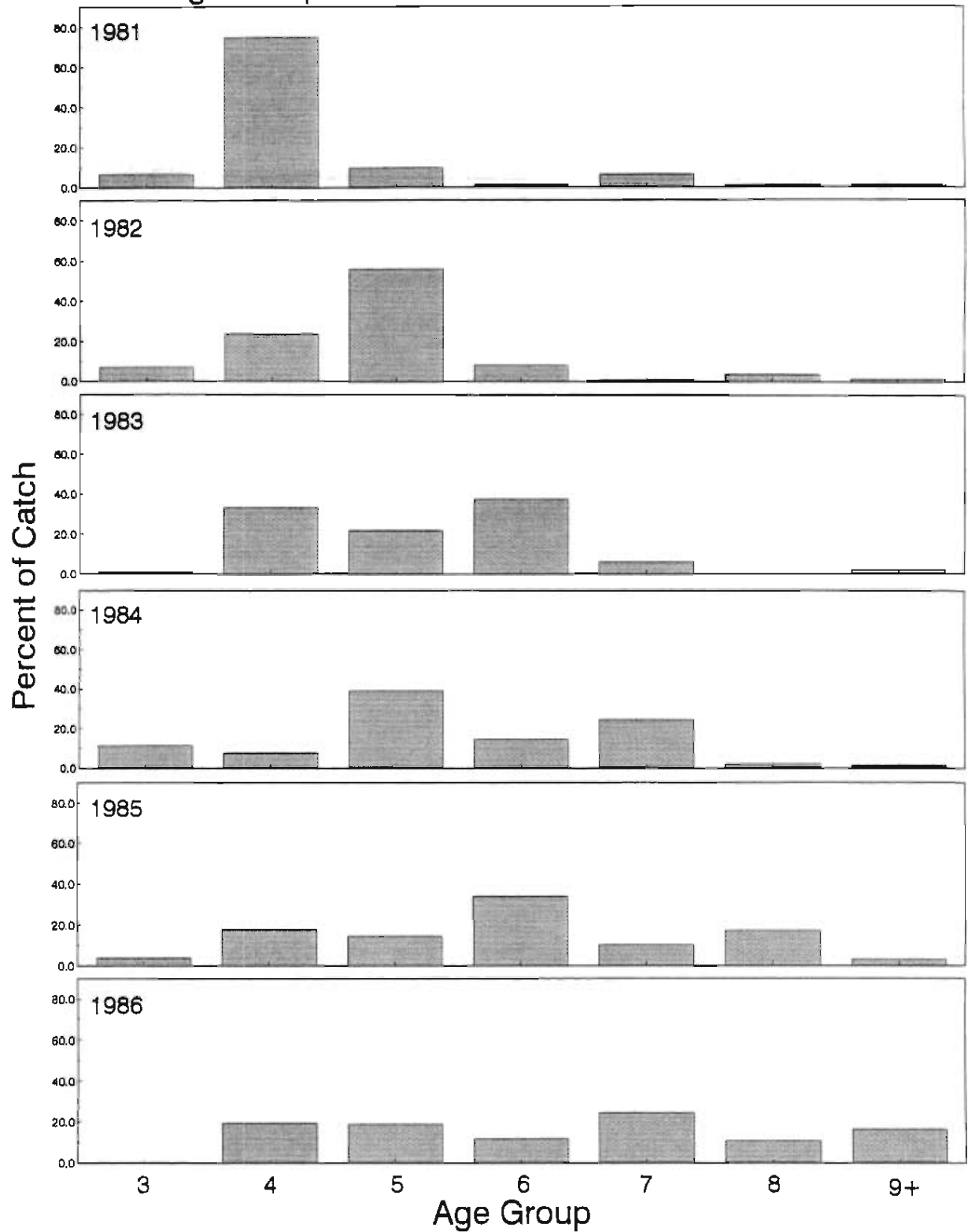


Figure 14. Norton Sound herring age class composition by percentage of total catch, variable mesh gill nets, 1981-1994.

Norton Sound District Age Composition of Variable Mesh Gill Nets

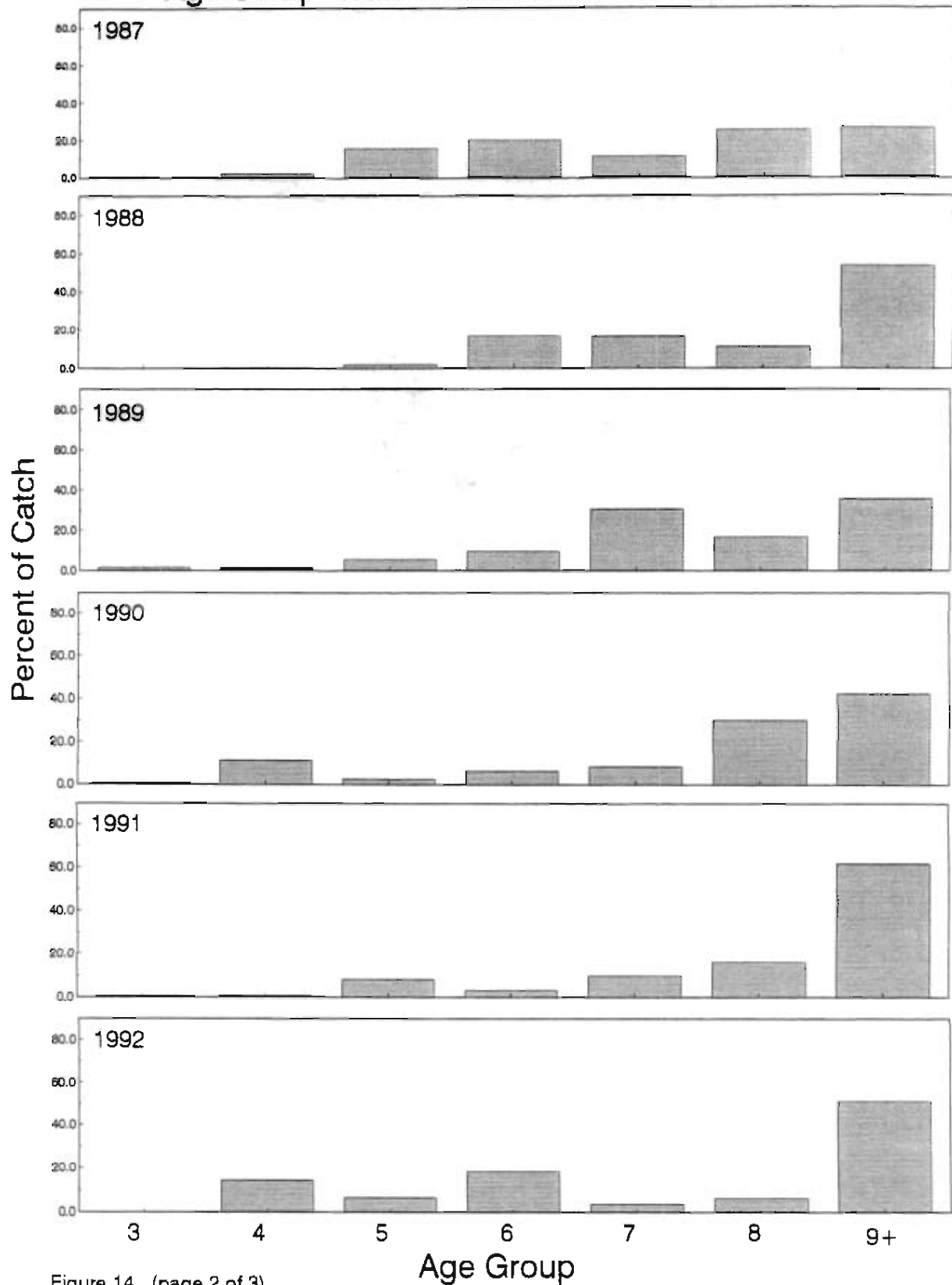


Figure 14. (page 2 of 3)

Norton Sound District Age Composition of Variable Mesh Gill Nets

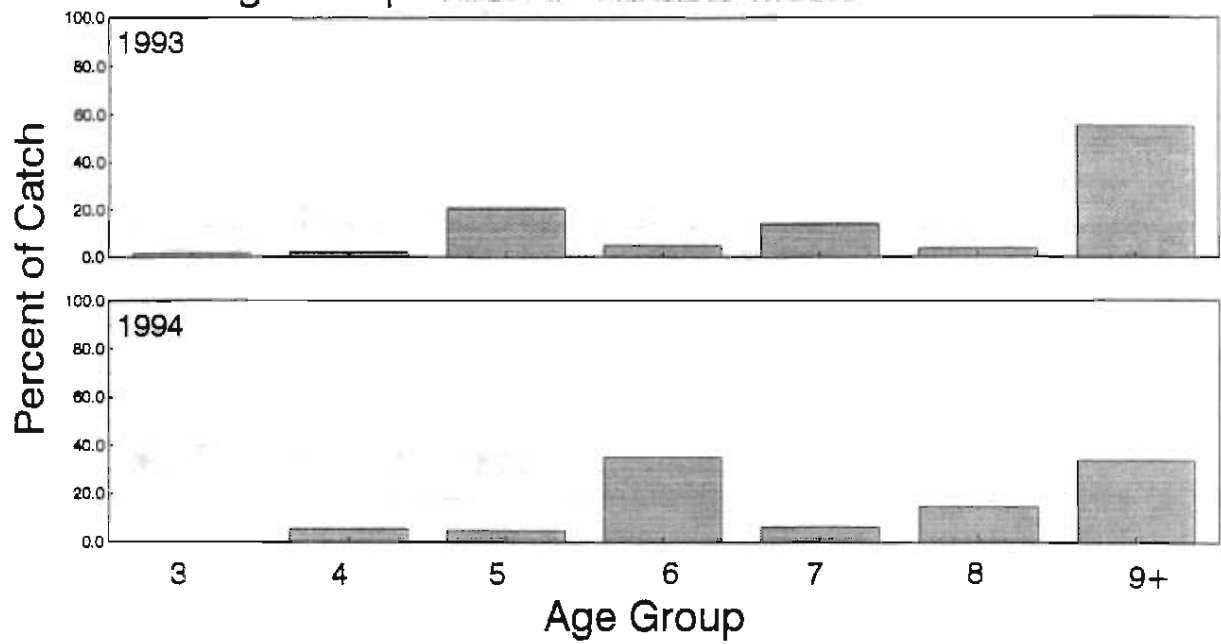


Figure 14. (page 3 of 3)

Norton Sound Herring

1994 Catch by Gear Type and the 1995 Projection

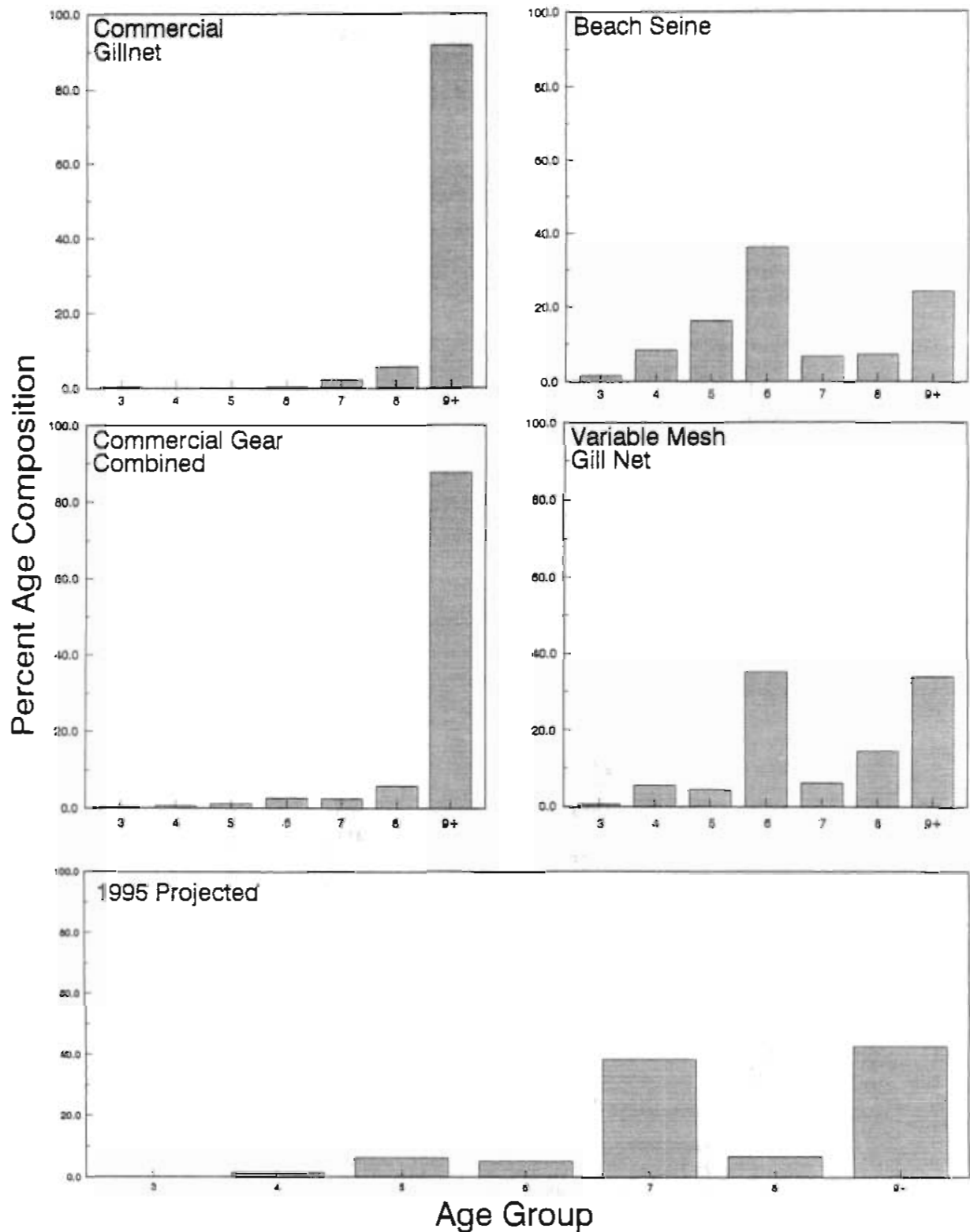


Figure 15. Norton Sound Pacific herring age composition comparison by gear type of capture, 1994, and the projected age composition of the 1995 return.

Appendix Table D1. Norton Sound herring and spawn-on-kelp harvests
(in short tons) by U.S. commercial fishermen, 1909-1994.

Year	Sac Roe Herring	Food or Balt Herring	Total	Spawn-on-kelp
1909-1916 ^a	-	-	-	-
1916-1928	-	1881	1881	-
1929	-	166	166	-
1930	-	441	441	-
1931	-	86	86	-
1932	-	529	529	-
1933	-	31	31	-
1934	-	4	4	-
1935	-	15	15	-
1936	-	-	-	-
1937	-	6	6	-
1938	-	10	10	-
1939	-	6	6	-
1940	-	14	14	-
1941	-	3	3	-
1942-1963	-	-	-	-
1964	20	-	-	-
1965	-	-	-	-
1966	12	-	-	-
1967	-	-	-	-
1968	-	-	-	-
1969	2	-	-	-
1970	8	-	-	-
1971	20	-	-	-
1972	17	-	-	-
1973	35	-	-	-
1974	2	-	-	-
1975	-	-	-	-
1976	9	-	-	-
1977	11	-	-	trace
1978	15	-	-	4
1979	1292	-	-	13
1980	2451	1	2452	24
1981	4371	-	-	47 ^b
1982	3864	69	3933	38
1983	4181	401	4582	29 ^c
1984	3298	274	3572	19 ^d
1985	3420	128	3548	- ^e
1986	4926	268	5194	-
1987	3779	303	4082	-
1988	4256	416	4672	-
1989	4494	247	4741	-
1990	5253	1026	6279	-
1991	5465	207	5672	-
1992 ^r	-	-	-	-
1993	4713	321	5034	-
1994	958	2	960	-

^a Fishery occurred some years, but harvest unavailable.

Fishery from 1909-1941 occurred near Golovin; 1964 to present has occurred in southeast Norton Sound.

^b Does not include approximately 6 st of wastage.

^c Does not include approximately 2 st of wastage.

^d Includes 3 st of spawn on *Macrocystus* kelp.

^e All spawn-on-kelp fisheries closed by regulation prior to the 1985 season.

^r No commercial fishery took place in 1992.

Appendix Table D2. Japanese gillnet herring catches in Norton Sound, 1968-1977.
(North of 63 N. Latitude and East of 167 W. Longitude)

Year	Gillnet Catch (st)	Remarks
1968	131	First foreign effort on herring in Norton Sound
1969	1400	Peak catch with large effort (about 40 ships). Two vessels apprehended.
1970	69	
1971	703	
1972	15	
1973	38	
1974	764	
1975	0	
1976	-	Data unavailable.
1977	-	Herring fishery closed to foreign nations.
Total	3120	Excludes 1976 catches.

Appendix Table D3.

Herring biomass estimate and commercial fisheries data for the Norton Sound District, 1979-1994. ^m

Year	Biomass ^a (st)	Harvest ^b (st)	Percent ^c Exploitation	Roe %	Dollar Value (millions)	Number of Fishermen
1979	7,700	1,292	16.8	7.0	0.6	67
1980 ^d	8,400	2,452	29.2	8.1	0.5	294
1981	25,100	4,371	17.3	8.8	1.5	332
1982 ^d	17,400	3,933	22.6	8.8	1.0	237
1983	28,100	4,582	16.3	8.6	1.4	272
1984	23,100	3,662 ^e	15.8	10.3	0.9	194
1985	20,000	3,548	17.7	9.9	1.4	277
1986	28,062	5,194	18.5	9.6	2.9	323
1987	32,370	4,082	12.6 ^f	8.6	2.6	564
1988	33,924	4,672	13.8 ^g	9.0	3.9	348
1989	23,857	4,771 ⁱ	20.0 ^h	9.2	2.3	357
1990	35,522 ^h	6,439 ^j	18.0	8.7	3.6	365
1991	42,854	5,796 ^k	13.5 ^f	9.3	2.4	279
1993	46,549	5,034 ⁱ	10.9	9.9	1.5	264
1994	37,829	960	2.5	10.3	0.3	215

^a Methods of calculating biomass have varied over the years. Biomass estimates listed follow methods used during that year.

^b Includes both bait and cas roe harvests.

^c Represents total District exploitation. During many years southern subdistricts are closed because exploitation of the local biomass reaches 20%, while northern subdistricts have remained open because little or no harvest has occurred.

^d Minimal biomass estimates due to poor survey conditions.

^e Includes an estimated 90 st of wastage.

^f Peak estimate made after the commercial fishery; the fishery was not re-opened due to the high probability of spawnouts present after two consecutive days of heavy spawning.

^g Peak biomass was sighted prior to arrival of the commercial buying fleet.

^h Biomass spotting conditions very poor throughout herring season; peak biomass represents minimum estimates; exploitation rate based on observed biomass.

ⁱ Includes an estimated 30 st of wastage.

^j Includes an estimated 60 st of wastage.

^k Includes an estimated 125 st of wastage.

^l Does not include an estimated 45 st of wastage.

^m No herring fishery occurred in 1992.

Appendix Table D4. Norton Sound commercial herring harvest (st) by subdistrict, by year, 1979 - 1994. ^a

Year	Subdistricts							Totals
	s.d. 1	s.d. 2	s.d. 3	s.d. 4	s.d. 5	s.d. 6	s.d. 7	
1979	319	405	555	-	-	-	14	1293
1980	1176	632	632	5	-	7	-	2452
1981	3068	831	471	1	-	-	-	4371
1982	2062	946	925	-	-	-	-	3933
1983	434	1265	2733	-	65	85	-	4582
1984	-	-	3572	-	-	-	-	3572
1985	1538	188	1675	-	147	-	-	3548 ^b
1986	2559	-	2450	-	185	-	-	5194
1987	2218	174	1690	-	-	-	-	4082
1988	3260	99	1307	-	6	-	-	4672
1989	3256	60	1425	-	-	-	-	4741 ^c
1990	4498	950	931	-	-	-	-	6379 ^d
1991	-	880	4792	-	-	-	-	5672 ^e
1992 ^f	-	-	-	-	-	-	-	0
1993	2288	587	1881	-	278	-	0.2	5034.2 ^g
1994	250	36	634	-	40	-	-	960

^a Includes herring taken for sac roe and bait.

^b Does not include an estimated 90 st of wastage.

^c Does not include an estimated wastage of 30 st in abandoned gillnets.

^d Does not include an estimated wastage of 60 st in abandoned gillnets.

^e Does not include an estimated wastage of 125 st in abandoned gillnets.

^f No commercial fishery in 1992.

^g Does not include an estimated wastage of 45 st in abandoned beach seine sets.

Appendix Table D5. Norton Sound commercial spawn-on-kelp (Fucus) harvest, 1978-1984.^a

Year	st	Number of Fishermen
1978	4	9
1979	13	19
1980	24	20
1981	47	22
1982	38	44
1983	29	35
1984	19	32

^a Norton Sound commercial spawn-on-kelp harvest closed by regulation prior to the 1985 season.

PORT CLARENCE / KOTZEBUE DISTRICTS

Introduction

The regulation book states that in the Port Clarence and Kotzebue Districts, herring may be taken from April 15 through November 15, except that herring may not be taken during the open commercial salmon fishing season. However, prior to the 1987 season, no spring sac roe commercial fisheries had ever occurred within these districts. Interest in exploring these stocks has been expressed in recent years by industry personnel operating in the Norton Sound District. However, no large scale effort to develop the fishery has occurred due to the late ice breakup and fishery timing in the Port Clarence and Kotzebue Districts.

The Port Clarence and Kotzebue commercial herring fisheries have been in regulation since 1982. The 1983 and 1984 regulation books set a guideline harvest of 150 mt (165 st) for each district. Since the guideline harvest has never been changed or repealed by the Board of Fisheries, it is assumed 165 st guideline harvest is still in effect. Presently purse seines, beach seines, and gillnets are legal commercial gear within these districts.

Local fishermen from Teller, Shishmaref, and Kotzebue have also expressed increasing interest in exploiting these stocks. While small harvests of herring for food/bait have occurred during the fall, the fisheries in these districts have been limited by lack of markets. Local fishermen and fishery operators in Kotzebue, Brevig Mission and Nome have also expressed interest in developing a spawn-on-kelp fishery within these districts.

Resource Investigations

Resource investigations of Port Clarence and Kotzebue Sound area herring stocks were conducted by ADF&G from March 1976-September 1978 (Barton 1978). These studies indicated that herring populations from Golovin Bay (Norton Sound) northward differed significantly in size and behavioral characteristics from herring populations occurring in the southern Bering Sea. Differences between populations were summarized as follows (Barton, 1978).

Seward Peninsula Populations

Southern Norton Sound to Southern Bering Sea Pelagic Populations

Smaller herring at age with
lower vertebral counts.

Larger herring with probable
higher vertebral counts.

Lower abundance.

Higher abundance.

Subtidal spawning (3m) in
shallow bays, inlets and
lagoons.

Intertidal and shallow subtidal
spawning along exposed rocky
headlands.

Zostera sp. primary spawning
substrate.

Fucus sp. primary spawning
substrate.

More euryhaline.

Less euryhaline.

Overwinter in shallow bays;
water is warmed by river
discharge under ice cover.

Overwinter in deep ocean
layers near the Pribilof
Islands.

Fall (non-spawning) runs
documented.

No fall runs documented.

Larval development in brackish
water.

Larval development probable
in more saline water.

Data collected from herring populations along the Seward Peninsula strongly indicated that a separate stock of herring occurs in the Port Clarence and Kotzebue Sound areas. This does not preclude the possibility of the occurrence of more southern stocks from utilizing this region, i.e., stocks which winter near the Pribilof Islands and migrate to the western Alaska coast to spawn. It is unlikely however, that herring stocks along the Seward Peninsula migrate to the central Bering Sea for wintering, but rather remain in coastal lagoons, bays or inlets which are warmed by river discharge under the ice (Barton 1978). This may be a major factor in explaining size differences, i.e., environmental conditions. Water temperatures and feeding conditions in deep ocean waters are probably more favorable for growth than those in herring winter habitats along the Seward Peninsula, which apparently have become adapted to Arctic conditions (Barton 1978).

Aerial surveys are very difficult in the Port Clarence District due to organic coloring of the waters of Imuruk Basin, Tuksuk Channel, Grantley Harbor and to a lesser extent, Port Clarence. Aerial surveys were impractical in Imuruk Basin and Tuksuk Channel. Additionally, the presence of other species of fish caught in test commercial gear sets indicate the need for verifying any biomass

sighted. A further complicating factor within Port Clarence is the spring ice conditions. The Port is a very sheltered body of water which becomes stained to a high degree over the winter and takes some time to clear once the ice melts. Typically, the outside waters are significantly warmer than the inside waters which are covered by ice longer thereby slowing solar gain and water mixing. Soon after the ice begins to shift the herring move into the warm shallow lagoons to spawn. The herring are invisible to aerial observation once they enter the stained water. The best aerial survey conditions exist just outside the entrance to the Port, where the herring mass just prior to the ice moving. One or two surveys have been flown each of the past five years, but virtually no herring have been observed because the narrow window of time for seeing the fish has been missed.

Fall Food/Bait Fishery

Although a fall fishery has probably existed for subsistence use within these areas for many years, a commercial venture has only been attempted recently. During the falls of 1986 and 1987, small harvests herring were recorded from the Port Clarence District. The primary use of those fish were crab bait and dog food. During September and the ice free portion of October 1994, four fishermen sold 8,706 pounds of herring at \$0.45 per pound. This level of harvest was facilitated by a fish buyer located in Nome who provided a ready crab bait market and transportation for the fish.

Sac Roe Fishery

The Port Clarence fishermen have been unable to attract a sac roe buyer for their relatively late fishery. During 1991, one individual imported *Macrocystis* kelp and attempted an open pound. No herring spawned on the imported kelp, although ripe herring were found in close proximity and very light spawn was found on blades of *Zosteria* nearby.

SECTION 3: KING CRAB
(Includes Norton Sound,
Port Clarence and Kotzebue Districts)

SECTION 3 - KING CRAB

INTRODUCTION

Norton Sound

The Norton Sound section of the Northern district in Area Q is described in the shellfish regulations as all waters east of 168 degrees W. long., between the latitudes of Cape Romanzof and Cape Prince of Wales (Figure 1). The only shellfish fishery in Norton Sound is for red king crab (*Paralithodes camtschatica*). Blue king crab (*P. platypus*) and Tanner crab (*Chionoecetes opilio*) also occur within this section but are very seldom caught by commercial or subsistence fishermen. Red king crab have been utilized for subsistence purposes by local residents for many years, but the commercial fishery was not initiated until 18 years ago. In April 1977, the Alaska Board of Fisheries opened an "exploratory" commercial fishery in order to increase the knowledge and commercial utilization of Norton Sound king crab. Since 1976 there have been six National Marine Fisheries Service (NMFS) research trawl studies in Norton Sound. The most recent survey was conducted in 1991 (Table 3, Figures 3 & 4). In addition, the State of Alaska Department of Fish and Game (ADF&G) has conducted four research pot fishing studies. Data from population studies, from winter research studies, mining impact studies, and from 17 commercial fishing seasons has greatly increased the knowledge of the Norton Sound king crab. There are two seasons during which crab may be taken commercially: November 15 - May 15 and July 1 - September 3.

St. Lawrence Island

The St. Lawrence Island section lies immediately west and north of the Norton Sound Section. Until recently, the St. Lawrence Island section has been managed by Westward Region's Dutch Harbor office. This arrangement occurred because the Bering Sea crab fleet bases in Dutch Harbor. Both sections have been open to commercial fishing for the same amount of time. The only reported commercial catches to date in the St. Lawrence Island section were made in 1983 when 52,557 pounds of blue king crab were delivered from 13 landings, in 1989, when 3,603 pounds of red king crab and 984 pounds of blue king crab were delivered from 8 landings and in 1992 when 53 pounds of blue crab were landed.

In 1983 the commercial crab fleet concentrated near the southeast shore of St. Lawrence Island. The following year a regulation proposal to close the waters within 10 miles of all inhabited islands within the section was adopted in an attempt to protect stocks targeted by local fishermen and reduce impacts on subsistence marine mammal harvests during the winter. During the 1989 season, relatively few blue king crab were taken near rocks and shoals still open to commercial fishing, but red king crab were discovered in low densities near Kivalina, the northern boundary of the section. The villagers of Little Diomed Island have also traded and sold winter caught blue king crab with residents of Nome and other villages for years. The Department has not been able

to obtain an accurate record of the magnitude of this trade. The remoteness of this village is also a factor contributing to the lack of catch records. Current regulation allows the commercial harvest and sale of king crab near shore during the winter. The Board provided the same provisions in the regulation as are in effect for Norton Sound to allow a commercial winter fishery. However, local residents of St. Lawrence Island have decided not to export any of their winter catch for commercial sale.

1994 COMMERCIAL FISHERY

Norton Sound Summer Commercial Fishery

The 1994 Norton Sound section commercial red king crab season opened by regulation at noon, July 1. A total of 85 catcher vessels composed of herring gillnetters and seine vessels were registered for the fishery. However, 34 vessels made deliveries and 52 permits were fished. There was some crew turnover and several fishermen made deliveries to document their participation in the summer fishery should it become important in the future. The first two vessels registered on June 24. The last vessel to register did so on July 27. More than half the registered vessels were from eastern Norton Sound villages. Most intended to fish in the vicinity of their respective villages. A total of 55 fishermen in eastern Norton Sound registered for the 1994 fishery. Early on in the season, eastern Norton Sound fishermen made an attempt to harvest crab in the areas closest to their villages, but were generally unsuccessful. Those fishermen either stopped fishing or shifted their effort to the Nome area where the fishery historically occurred. The season was open for 31 days and was closed by emergency order at 6:00 p.m. ADT, Sunday, July 31, when it was anticipated a harvest of 340,000 pounds of legal male king crab would be reached. The closure announcement was made with 72 hours notice, between 4:00 p.m. and 6:00 p.m. July 28.

All fishermen returned their fish tickets prior to August 2. The total reported harvest was 327,858 pounds including the reported deadloss of 986 pounds. The average price paid per pound of landed crab was \$2.02 per pound. The catches this season were reported from nine statistical areas (616331, 636401, 636402, 646401, 646402, 656401, 656402, 666401, and 666402). The fleet averaged 9.3 legal crab per pot pulled; a total of 108,824 crab were captured in 11,729 pot lifts. The average weight of legal male crab was 3.1 pounds, 0.2 greater than the previous season.

Catch sampling was done by a single ADF&G port sampler stationed in Nome. This person was also placed on board small catcher vessels four times throughout the fishery. A total of 404 legal male crab, 879 sublegal male crab and 131 female crab were sampled for legal size, sex, and biological length and condition. The mean carapace length for legal male crab was 119.2mm; the recruit and postrecruit proportions were respectively 14% to 86%. This represents the lowest recruitment level since 1983 and roughly 39% of the 1983 - 1993 recruit average (36%). Sublegal crab sampled were also comprised of an unusually high number of skipmolts.

The Norton Sound guideline harvest level of legal male red king crab for the 1994 season was 340,000 pounds. This conservative quota was set prior to the season using preliminary data from the fall 1991 National Marine Fisheries Service (NMFS) trawl survey, which placed the current population size at about 1/3 of the historic population level. The population of legal male crab has remained fairly stable since 1985, with only a limited increase in the number of legal king crab. Exploitation levels were maintained near 15% until 1988 when a decline in the number of legal males caused the exploitation rate to be reduced. The guideline harvest level of 340,000 pounds equated to an exploitation of approximately 10%. Authority for establishing a lowered exploitation rate was set by the Alaska Board of Fisheries during the spring 1988 meeting, which amended the existing harvest strategy regulation 5AAC 34.080.

Board of Fisheries regulations specific to Norton Sound Section are:

- 1) 5AAC 34.915, which directs the Department to manage the Norton Sound summer king crab fishery for a harvest of one-half the exploitation rate determined under 5AAC 34.080.
- 2) 5AAC 34.935, which established a closed area with a defined boundary approximating 15 miles from the beach in the Norton Sound section, to protect a long established winter subsistence fishery.

Regulation 5AAC 34.935 (CLOSED WATERS) also allows the Department the flexibility to reduce the closed waters area to allow an efficient harvest of red king crab during the summer fishery. The decision to relax the closure line to roughly 10 miles from the beach was announced June 28. The regulatory season dates were advanced one month in 1993. Catch rates had been slow in early July, but were increased as the closure line was relaxed. Therefore, the early timing of the fishery and the seasonal migration is thought to cause the lower catch rates. An increased catch rate should occur by allowing fishing nearer the shore. Another emergency order relaxing the closure line in eastern Norton Sound was announced July 8. Catch rates had been quite slow, and residents of eastern Norton Sound villages had requested that commercial fishing be allowed in areas accessible to their villages.

- 3) 5AAC 34.925 (i) and (j), requiring pot tags and limiting vessels of 125 feet in length or less to 40 pots each and larger vessels are limited to 50 pots.

This new regulation, 5AAC 34.925, along with a regulation making Norton Sound a superexclusive registration area was responsible for the change in character of the fishery during the 1994 season. Apparently, many large vessel owners felt their vessel would not be able to compete economically under the new pot limit and exclusivity requirements. No large vessels participated in this year's fishery.

Unavoidable delays in the fishery were caused by two storms. The first storm on July 23 kept the fleet in port one day. Most vessels anticipated the second storm on July 31, and the majority of the pots were pulled July 30. The larger boats of past seasons had continued to fish during the

milder storms or the short seasons were arranged to occur after storms. Some pots were lost during the 1994 storms.

This was the first commercial summer crab season during which a significant portion of the harvest was processed in Nome. Approximately 36% percent of the harvest or 117,799 pounds were processed in Nome. Two shore based processors operated in Nome, and three other buyers flew crab to Anchorage to be processed. Eleven fishermen were registered as catcher sellers. The following is a breakdown of fishing effort by fishing group origin:

<u>Fishing Group</u>	<u># of Boats</u>	<u>Pounds of Crab Harvested</u>
Norton Sound	18	59,415
Yukon Delta	9	142,613
Alaska-non local	3	32,417
Non-Alaskan	4	93,413

The good weather allowed boarding for tank inspections and registrations of all vessels. Skipper and Buyer cooperation and compliance with the verbal catch reporting was good. Fish and Wildlife Protection provided their King Air aircraft to fly the closed waters on July 6. The Nome Fish and Wildlife officer also made spot checks of vessels throughout the season to enforce size and sex restrictions.

Norton Sound Winter Commercial Fishery

Regulation allows a winter through-the ice commercial fishery in the Norton Sound Section from November 15 through May 15 which typically takes place near Nome. During the winter of 1993-1994, 25 commercial fishermen reported selling a total of 5,649 red king crab (Table 2). The villages east of Nome are reporting harvests of crab for the third year in a row. Although ice conditions were unfavorable in the Unalakleet and Shaktoolik area, Elim reported four percent of the harvest and a small harvest was reported from the vicinity of St. Michael. The harvest is split between local residents who buy crab directly from the fishermen and Anchorage or non local markets. Crab sell in Nome for six dollars a piece and Anchorage prices are around \$3.50 per pound, resulting in an average price of \$3.01 per pound. The 1993-1994 winter catch of 17,214 pounds was estimated to be worth about 51,814 dollars.

The winter crab fishermen generally use crab pots but some use handlines to "prospect". Most fishermen consider commercial crabbing to be a sideline and hold other jobs. Usually, two or three fishermen sell the bulk of the crab. Because of the low volume of crab involved, no processor has found it profitable to operate locally. The crab sold locally are all sold fresh as are those shipped to Anchorage or other non local markets. During the mid-winter months fishermen find it difficult keeping the crab from freezing. Many Nome residents prefer to buy frozen crab since they are able to extract the meat prior to cooking. Fresh frozen crab are easily marketed in Nome but are not accepted in Anchorage.

SUBSISTENCE FISHERY

Red king crab are utilized by Norton Sound residents mainly during the winter. Fishing occurs through holes or cracks in the ice with the use of handlines and pots. In order to document trends in the subsistence harvest, the Board of Fisheries enacted a regulation in 1977 requiring subsistence fishermen in Norton Sound to obtain a permit prior to fishing and record daily effort and catches on these permits (Table 2).

The first year subsistence permits were required had the highest number of permits issued to date with a relatively high harvest rate. The fishery declined sharply the following year and remained at very depressed levels through the 1981-82 season. The lack of success in the winter crab fishery during some past years has been attributed to a declining crab population caused by removal of crab in the summer commercial fishery together with low recruitment, low effort due to poor ice conditions, and changes in the nearshore winter distribution of crab. All of these factors probably had some effect on the success of the winter fishery in varying degrees. During the 1978-79 winter fishery, the king crab population was still judged to be relatively high. Despite this relatively large population, winter catches were the poorest on record indicating that the major factors limiting winter catches during 1978-79 were probably poor ice conditions and the distribution of crab. During the winter of 1981-82, poor winter catches could more reasonably be attributed to a declining crab population since the crab population was at its lowest documented level. Subsistence fishing success during the winters of 1982-83 through 1986-87 had improved due to a rebuilding of the population and increased use of more efficient gear (pots instead of handlines). Unstable ice conditions and record snowfalls adversely effected the 1987-88, 1988-89, and 1992-93 catches. During years of stable ice conditions, approximately 100 fishermen have averaged 100 crab each (Table 2).

The winter crab fishery is limited by extreme weather conditions. Shorefast ice can become unstable where crab pots may be carried away or fishermen are unable to cross open leads to get to their pots. Low air temperatures, wind and drifting snow are the primary factors that determine effort levels rather than crab densities.

STOCK STATUS / RESEARCH

In 1976 when monitoring of the Norton Sound king crab population first began, the population was mainly composed of prerecruit and recruit crab (Figures 4 & 5). This first population assessment survey by the NMFS estimated the legal male king crab population at 8.1 million pounds. The legal male crab population peaked in 1978 at an estimated 11 million pounds. During the 4 years following 1978, recruitment into the legal male crab population was very low. Subsequent NMFS surveys in 1979 and 1982 documented a population of predominantly postrecruit crab, and estimated the population had declined to 2.6 million pounds by 1982. The Department of Fish and Game conducted their first population assessment survey in 1980, with subsequent surveys in 1981 and 1982 (Table 3). These survey assessments documented a similar decline from 6.6 million pounds (1980) to 1.3 million pounds (1982). Beginning in 1981, sublegal crab abundance began

to increase, and by 1983 recruitment into the legal male population also began to increase. No assessment work was conducted in 1983 or 1984. However, samples of the commercial catch indicated a significant increase of recruit crab into the legal male population; from a historic low of 10% in 1981 to 59% in 1984 (Table 4).

In 1985 both NMFS and ADF&G conducted population assessment surveys in Norton Sound (Table 3, Figure 5). The Department fished 65 stations throughout Norton Sound capturing 4,645 legal males, of which one-third was tagged. Subsequent recapture of tagged crab by the commercial fleet in August of 1985 provided tag to untagged ratios, and the population prior to the fishery was estimated at 2.4 million pounds (Table 3). After the commercial fishery in 1985 NMFS conducted a population assessment survey using trawl gear over a slightly larger area than that surveyed by the Department. Catches of male king crab by NMFS were in the process of or had just molted with the result being that their estimate of 3.4 million pounds of legal male king crab included some recruitment. Adjusting this estimate for molting, and including the summer commercial harvest, the estimate became 3 million pounds present prior to the 1985 August fishery. Both surveys documented relatively substantial numbers of recruit crab and a healthy percentage of prerecruit crab.

During September of 1988 NMFS conducted a fourth population assessment with trawl gear. They swept an area roughly the same size as in 1985, but increased sampling frequency in the proposed mineral lease area near Nome. The timing of the study was almost a month earlier than similar surveys in the past, which occurred during the male molt. Nearly all the 1988 catch was in pre-molt condition. NMFS estimated 3.0 million pounds of legal male and 1.0 million pounds of prerecruit-one male red king crab; totaling 4.0 million pounds. Annual mortality is approximately 20% or in this case 0.8 million pounds. Ignoring growth and the winter harvests, the population prior to the 1989 summer fishery would have been 3.2 million pounds, very close to the 1985 trawl estimate of 3.4 million pounds.

NMFS conducted a fifth trawl survey of Norton Sound during late August 1991 with a reduced number of tows. Each station had only a single sampling tow as compared to each station having both a day and night tow during previous surveys. This reduction in sampling has the affect of introducing more variability into the estimate. The legal crab biomass in the summer fishing area was estimated to be 3,400,000 pounds and the total Norton Sound legal biomass was estimated to be 4,009,000 pounds. Since the survey occurred prior to the molt, a mortality of 10% was assumed for the year following the estimate. With no summer or winter fishery data to compare with the survey results, a conservative biomass of 3,400,000 pounds was used as the basis for the 1994 harvest guideline. The Norton Sound red king crab population was thought to be stable with harvest near 10%.

In-season sampling during the 1994 summer commercial fishery found the lowest rate of recruitment of legal males in that fishery since 1983 when that sort of data collection began. The incidence of skipped molts was double that of the long term average. Although no changes in the female indices were noted, that data base is less extensive. It would appear that recruitment did not keep pace with harvest and natural mortality during the 1993-94 season. The Norton Sound

population is considered to be depressed and rebuilding since 1983. The rebuilding trend should be sustained. A second concern is the rate of mating success will decline if a minimum level of large males is not maintained. Because the sample size was small and the incidence of molting might increase, no changes in management have been announced. A winter sampling project is planned to evaluate recruitment during March. A management plan for the summer of 1995 will be announced after the results of that study are available.

FUTURE INVESTIGATIONS

In addition to the population surveys, the Department has run a winter crab tagging project through the ice near Nome from 1983 through 1991 and in 1993. The winter crab studies began as an index of near shore crab abundance during the season of heaviest local subsistence use. Documentation of crab abundance is important because it provides an objective comparison of crab availability to an important subsistence fishery. Controversy over the availability of the crab resource to the local subsistence fishery is likely to continue in the future especially if winter crab harvests decline even for a short time. Unfortunately, the winter project was dropped prior to the past winter due to budget cuts. The staff was able to demonstrate that using past years' data how winter age/length data compares to commercial catch data.

Without current research studies such as the ADF&G surveys conducted in 1980-82, and 1985, and the NMFS trawl surveys conducted in 1976, 1979, 1982, 1985, 1988, and 1991, it will be very difficult to determine whether the legal male crab population of Norton Sound is being exploited at a level which will allow the population to stabilize and rebuild. The winter project is on track for the spring of 1995. It is intended to evaluate the level of recruitment and skip-molting after the October male molt. The 1994 summer season sampling indicated very little recruitment from the 1993 molt and the possibility of decline in the abundance of legal males.

Norton Sound has been included in the budget increment proposed to the legislature. Both funding for a sustained winter program and an annual trawl survey to evaluate Norton Sound crab populations are part of that proposal.

1995 OUTLOOK

The outlook for 1995 is stable. The low level of recruitment found from the samples collected during the 1994 summer season was reason for concern. Had the winter sampling project indicated a trend of poor recruitment had carried over through the 1994 molt, harvest levels would have been reduced. The possibility of a combination of time and area restrictions had been announced if the trend had continued. The decision was made after the results of the winter project were available in early April.

Table 17. Commercial harvest of red king crab from Norton Sound Section by statistical area, Northern Bering Sea District, 1994 (summer fishery only).

Statistical Area	# Vessels	Total Harvest Number	Total Harvest Pounds	Total Pots Lifted	Average Crab/Pot	Average Weight
616331	4	10	48	22	0.5	4.80
636401	11	2849	8087	380	7.5	2.84
636402	2	658	1754	76	8.7	2.67
646401	13	12511	37222	1287	9.7	2.98
646402	24	47730	143511	3576	13.3	3.01
656401	13	9806	29566	1214	8.1	3.02
656402	40	34749	106053	5050	6.9	3.05
666401	1	98	396	40	2.5	4.04
666402	3	413	1221	84	4.9	2.96
Totals		108,814	327,810	11,707	9.3	3.01

• Figure does not include 986 pounds reported as deadloss.

Table 18. Winter 1993-94 subsistence red king crab catches and effort by gear type, Norton Sound area.^a

Gear Type	# Permits Fished	# Males Caught	# Males Kept	# Females Caught	# Females Kept	Total Crab Captured	Total Crab Kept
Pots	55	4,374	3,851	253	27	4,627	3,878
Handlines	8	73	69	13	6	86	75
Both	2	122	115	14	0	136	115
Unknown	6	45	45	0	0	45	45
Totals	71	4,614	4,080	280	33	4,894	4,113

^a A total of 118 permits issued. As of 12/1/94: 95 permits returned; 17 permits not returned; 6 permits voided.

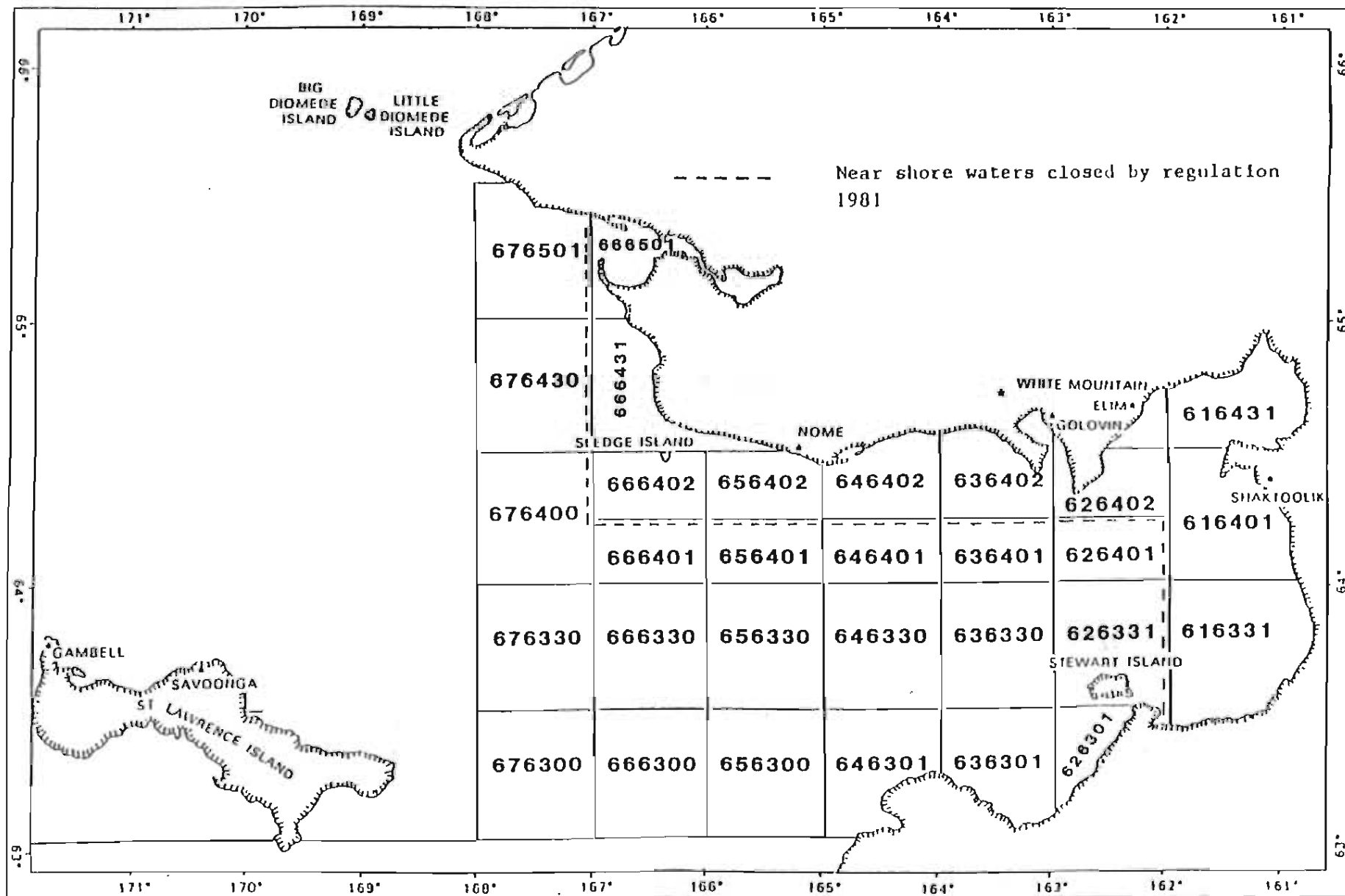


Figure 16. Statistical areas for the Norton Sound crab fishery.

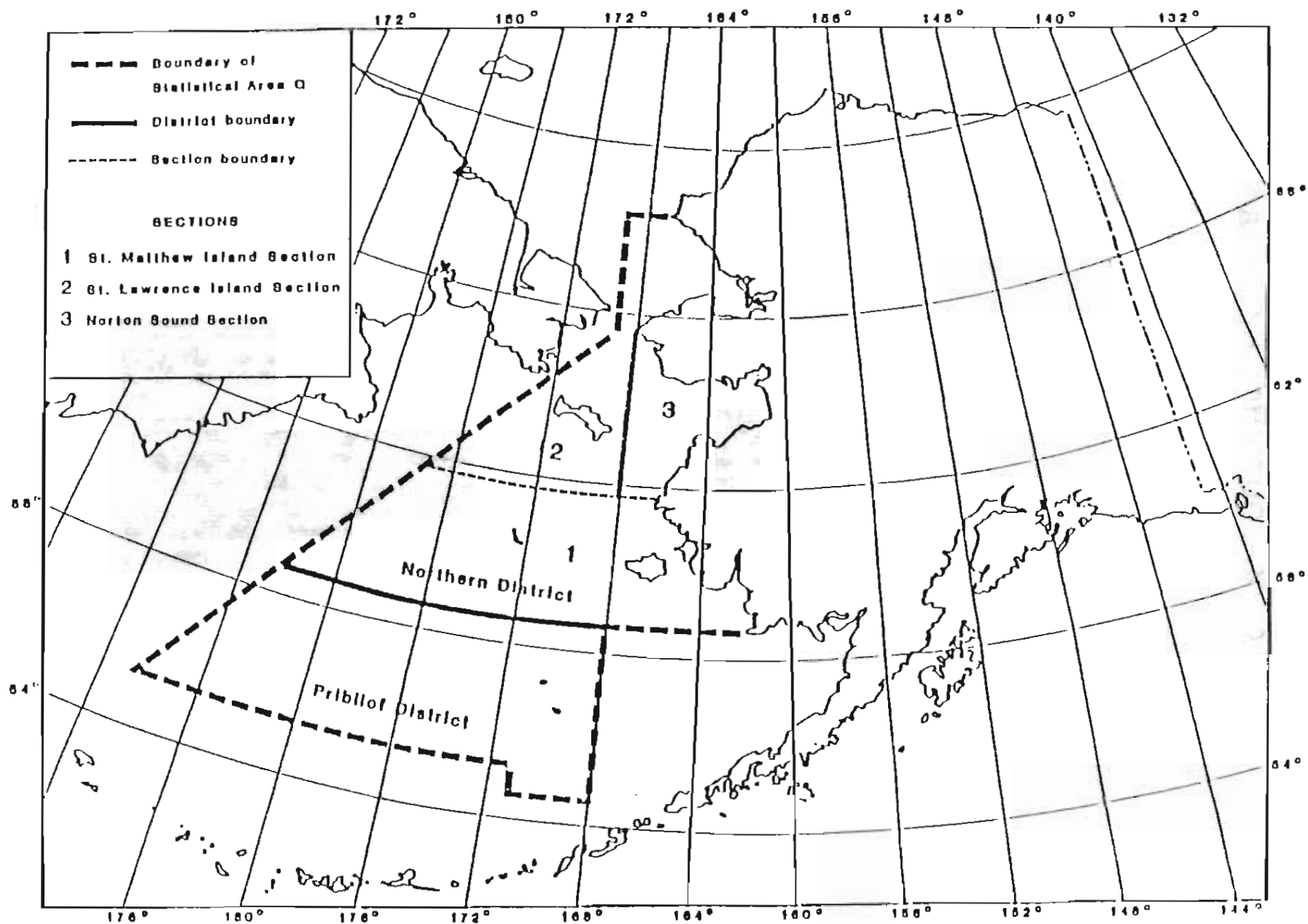


Figure 17. King crab fishing districts and sections of Statistical Area Q

Norton Sound Red King Crab

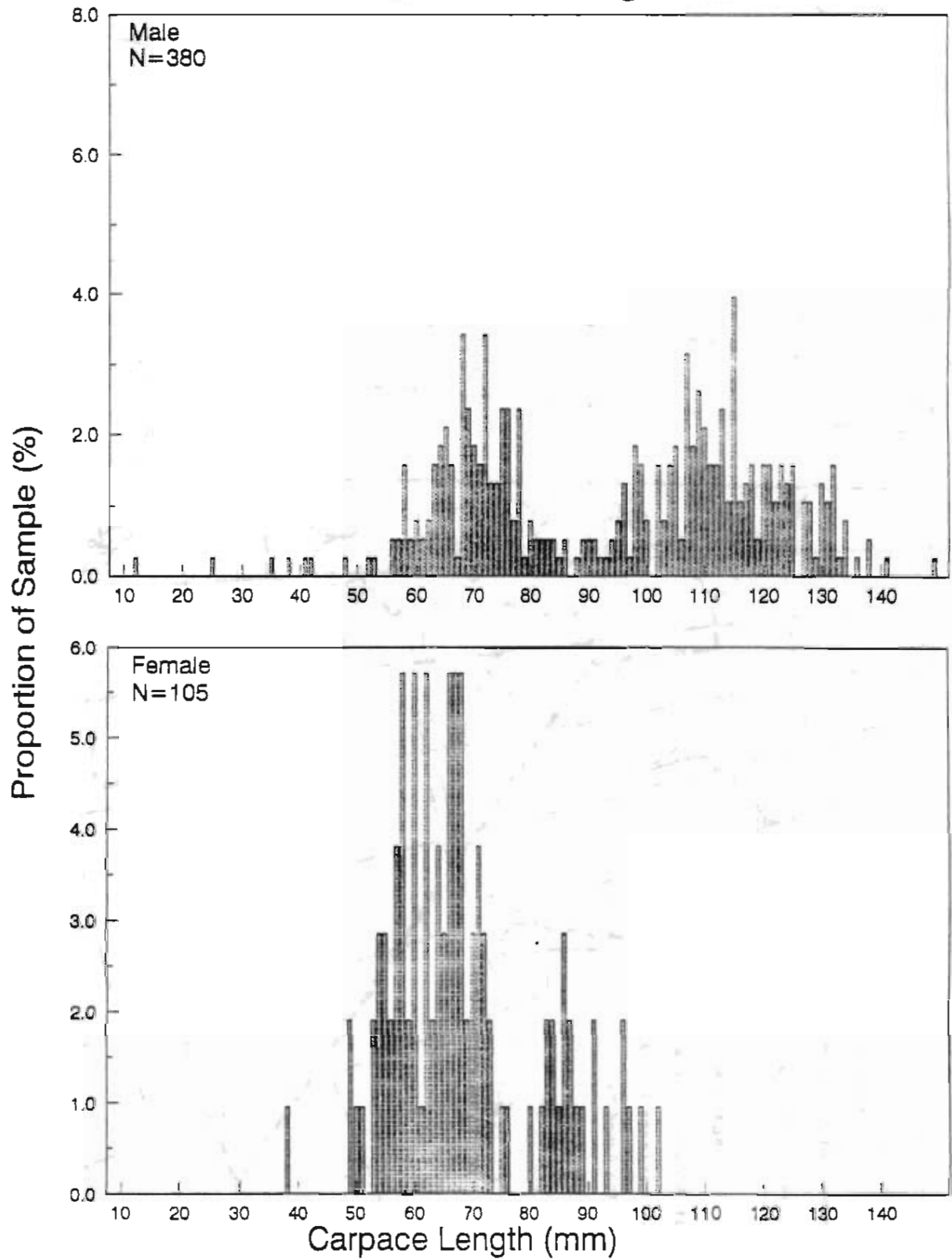


Figure 18. Norton Sound male and female red king crab size distribution from a trawl assessment survey conducted by the National Marine Fisheries Service, 1991.

Norton Sound Red King Crab

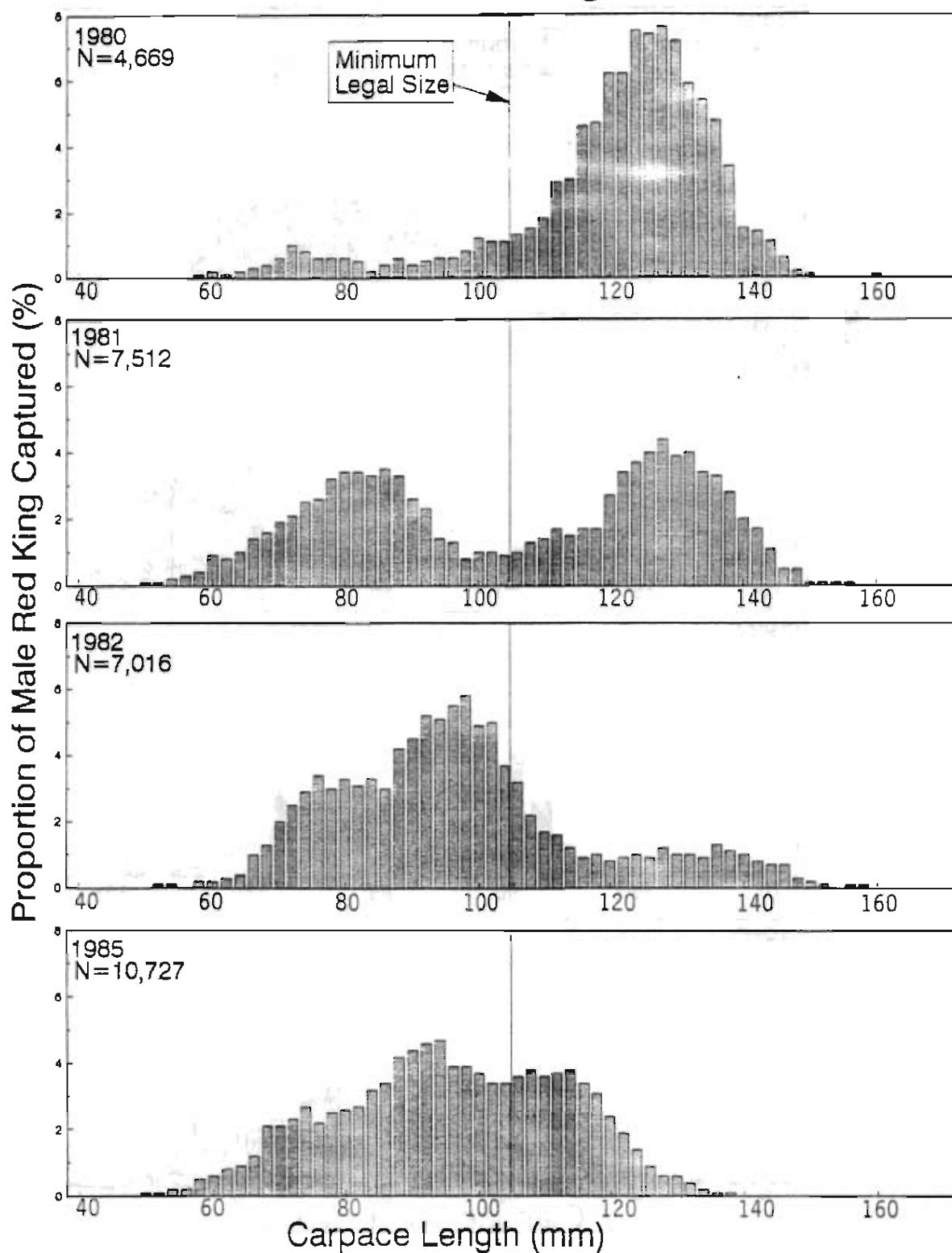


Figure 19. Norton Sound male red king crab size distribution from pot assessment surveys conducted by the Alaska Department of Fish and Game, 1980, 1981, 1982, and 1985.

Norton Sound Red King Crab

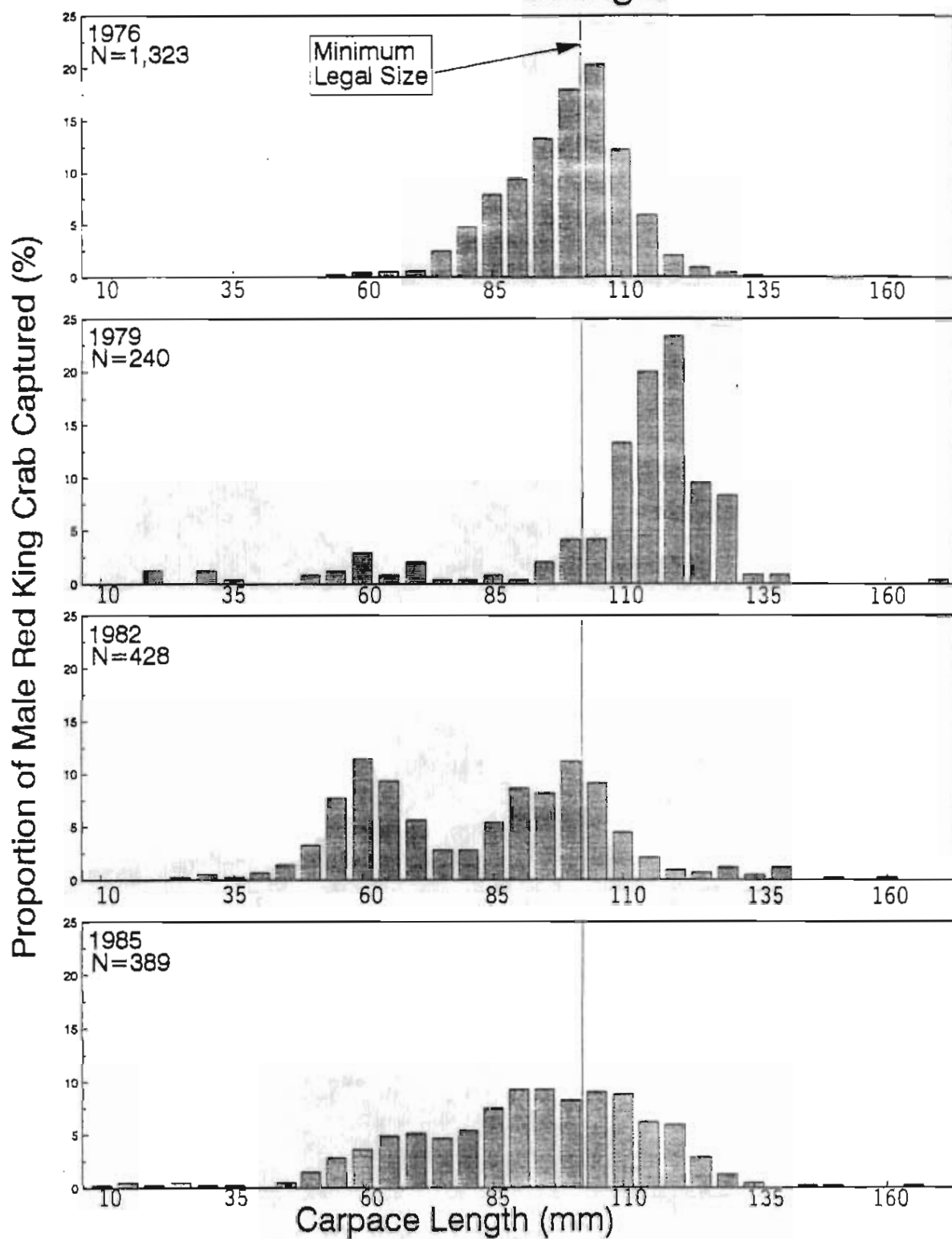


Figure 20. Norton Sound male red king crab size distribution from trawl assessment surveys conducted by the National Marine Fisheries Service, 1976, 1979, 1982, 1985, 1988, and 1991.

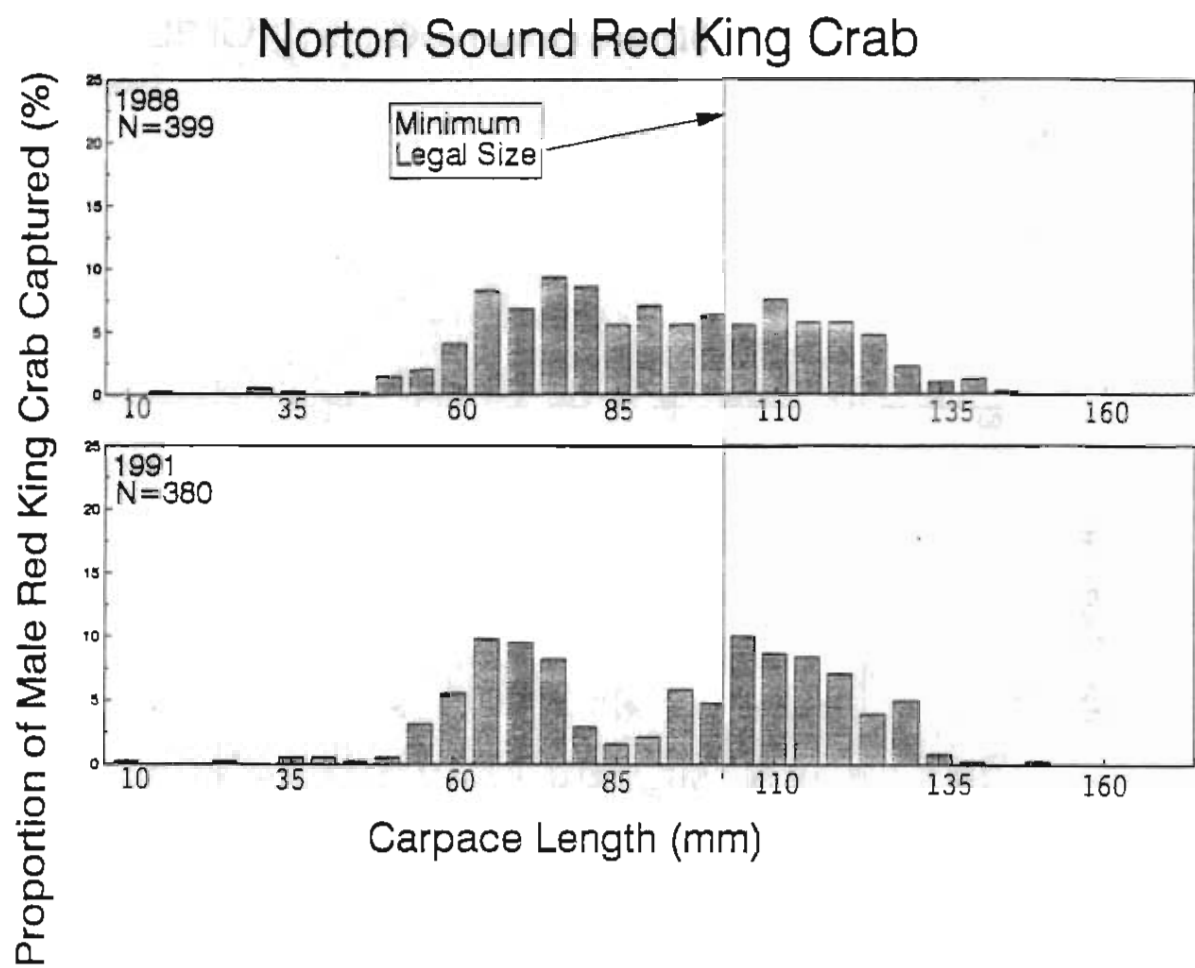


Figure 20. (Page 2 of 2)

Norton Sound Red King Crab

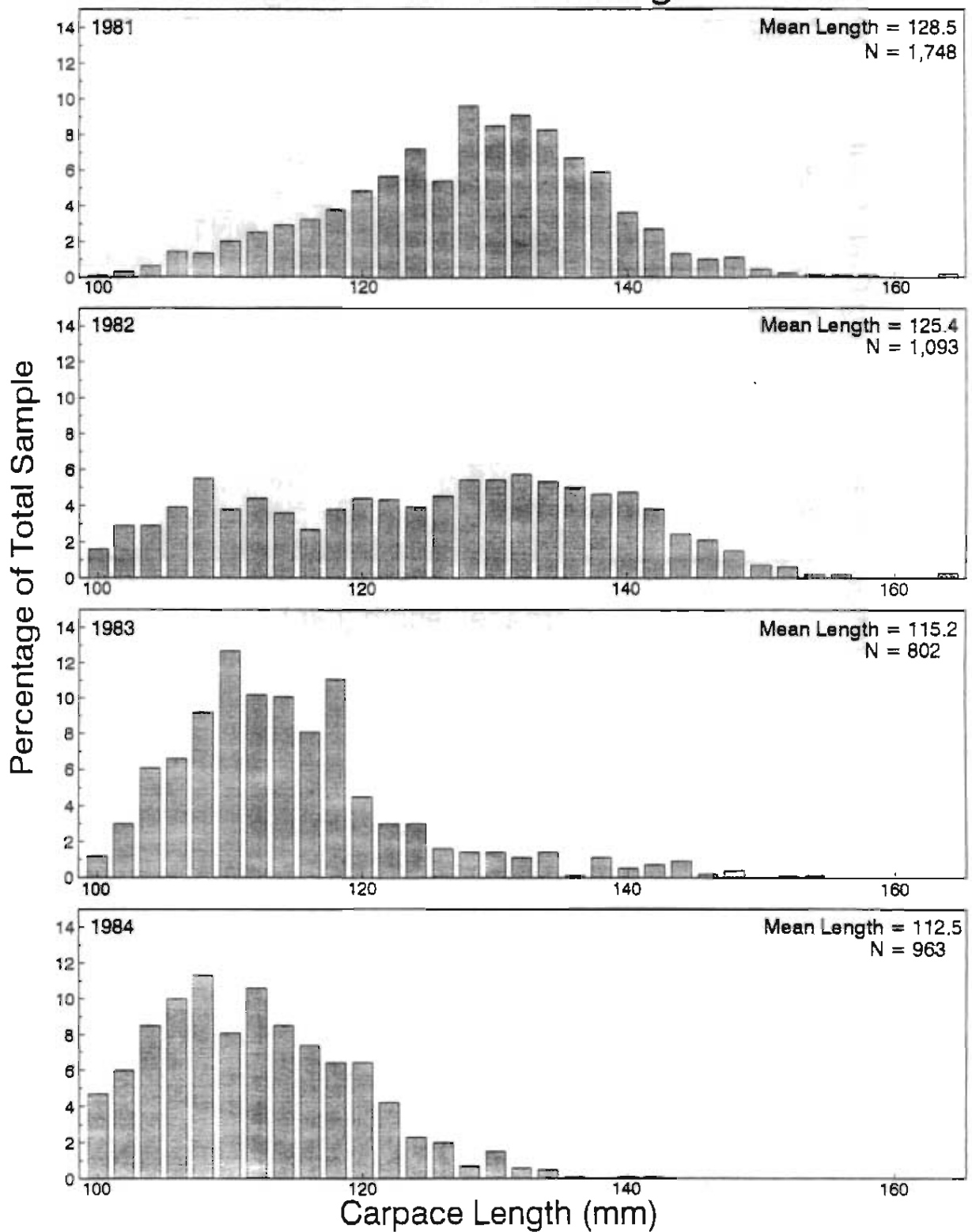


Figure 21. Norton Sound red king crab summer commercial catch samples, 1981-1994 (There was no commercial fishery in 1991).

Norton Sound Red King Crab

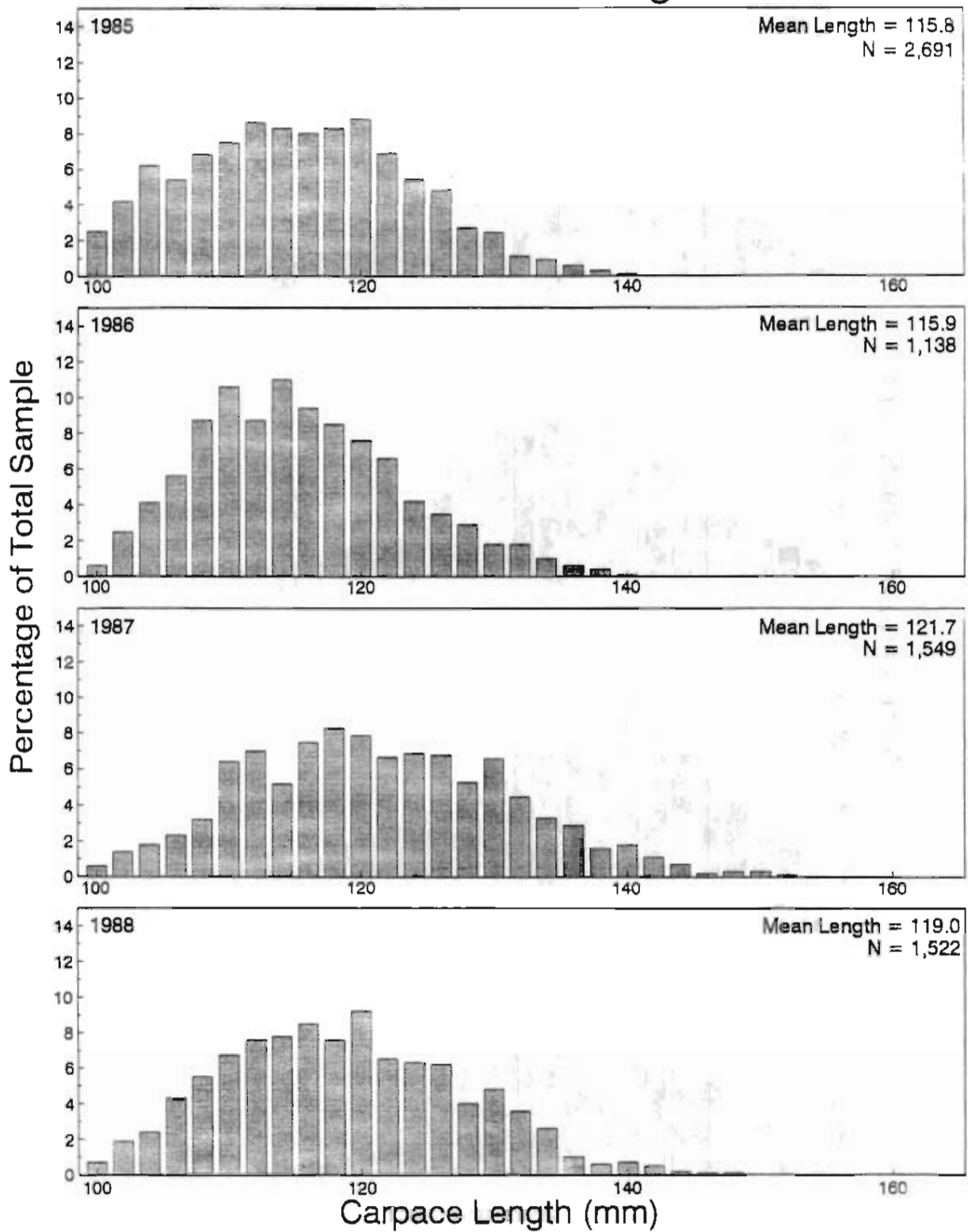


Figure 21. (page 2 of 4)

Norton Sound Red King Crab

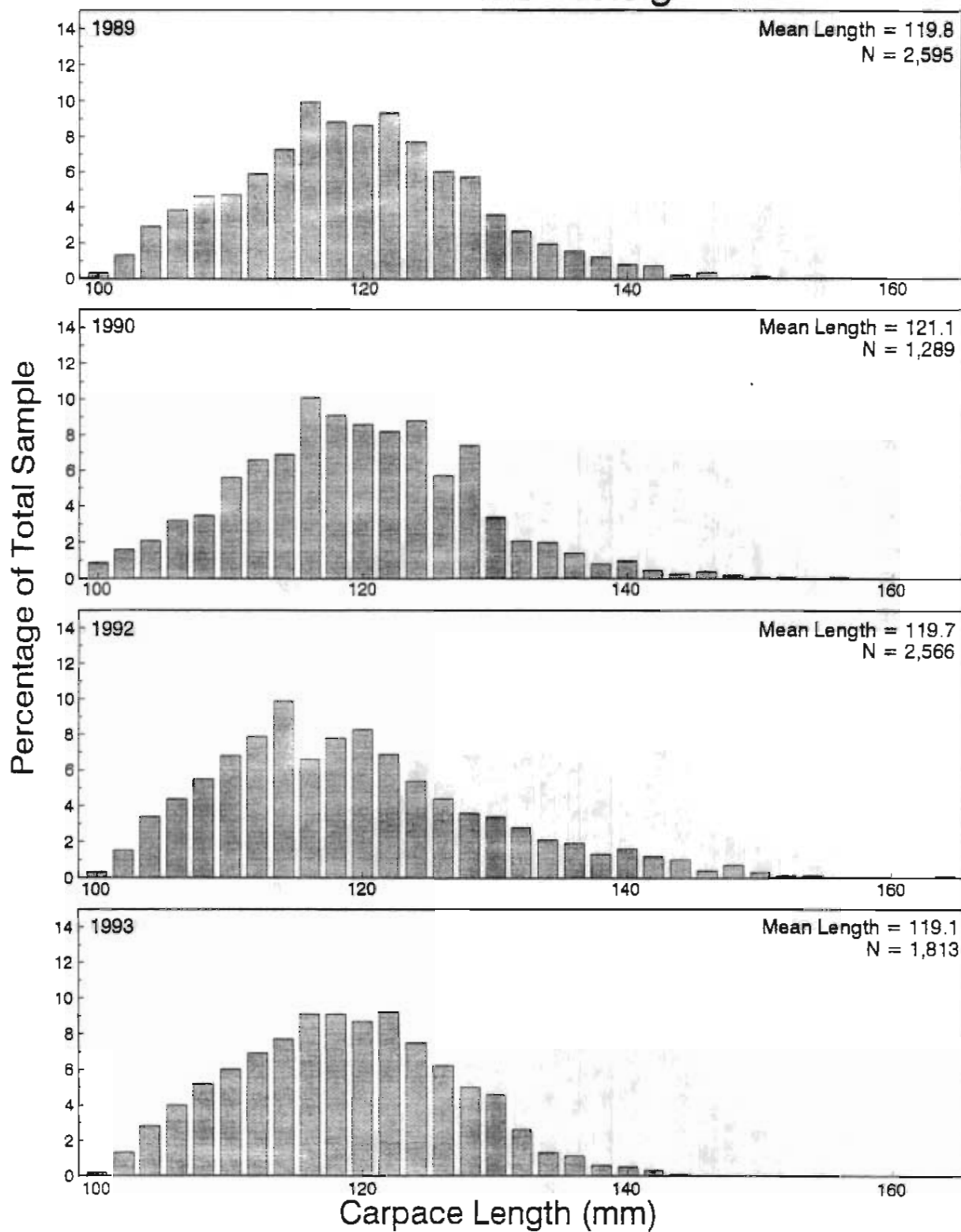


Figure 21. (page 3 of 4)

Norton Sound Red King Crab

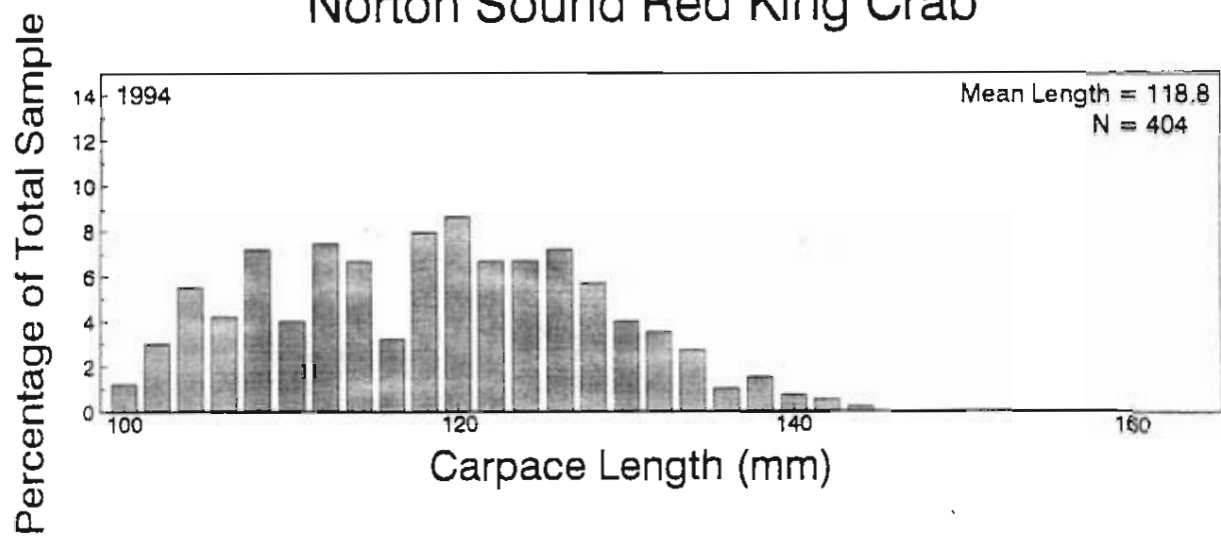


Figure 21. (page 4 of 4)

Appendix Table E1. Comparison of annual summer commercial harvest of red king crab from the Norton Sound Section, Eastern Bering Sea, by statistical areas, 1977-1994 (catch in pounds).

Statistical Area	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1992	1993	1994	Totals
656402	306,302	90,187	288,869	918	3,098	2,832			132,363							193,079	106,053	1,123,701
646402	80,969					748										730	143,511	225,958
626402	38,995																	38,995
636402																	1,754	1,754
656401			138,011	121,147	253,387	60,480	11,422	183,119	246,200		194,408	165,644	100,956	171	53,119	105,341	29,566	1,662,971
646401			155,972		1,319	17,532										1,963	37,222	214,008
636401				12,398	61,823	32,246	6,880	41	891				22,030		1,159	1,373	8,087	145,928
626401	31,572			4,830	399													36,801
656330			323,518	72,735	395,662	3,983	24,246	83,479	7,632		79,006	36,129	1,757		4,814	265		1,033,226
646330					4,716								5,212					9,928
626331	40,020					22												40,042
616331	7,893																48	7,941
656300			161,699		15,174													176,873
666431			146,029															146,029
676501					36													36
666402	12,036	515,778	534,938	183,581		17,585			32,992							535	1,221	1,298,666
676430		3,811	12,309	-0-	373	3,513			1,171									21,177
666401		179,212	486,947	205,400	381,510	79,580	325,045	116,254	5,341	408,848	50,744	21,895	115,257	162,263	10,632	746	398	2,550,070
676400		667,130	33,856	274	92,026	1,315	247		32					3,212				798,092
666330		353,016	505,050	367,446	141,513	8,990	1,192		389	70,615	2,963	13,020	1,275	27,185	4,305	31,758		1,528,717
676330		51,304	81,798	6,762	18,734	-0-												158,598
686330			1,860															1,860
666300		162,795	60,816	84,874	9,187	95		4,534										322,281
676300		13,238		126,231														139,469
666230		55,490			77													55,567
Totals	517,787	2,091,961	2,931,672	1,186,598	1,379,014	228,921	368,032	387,427	427,011	479,463	327,121	236,688	246,487	192,831	74,029	335,790	327,858	11,738,688

• No commercial fishery occurred in 1991.

Appendix Table E2. Percent recruit and postrecruit size male red king crab from commercial catch samples by year, Norton Sound Section, Bering Sea.

Year	Recruits ^a	Postrecruits ^b
1977	53	47
1978	29	71
1979	33	67
1980	15	85
1981	10	90
1982	27	73
1983	55	45
1984	59	41
1985	45	55
1986	49	51
1987	22	78
1988	25	75
1989	23	77
1990	21	79
1991 ^c	-	-
1992	28	72
1993	31	69
1994	20	80

^a Percent Recruits = All new shell, legal size, male king crab of carapace length <116mm.

^b Percent Postrecruits = All other, legal size, male king crab.

^c No Summer Commercial Fishery in 1991.

Appendix Table E3. Summer commercial red king crab harvests, Norton Sound, Bering Sea, 1976-1994.

Year	Legal Male Pop. Est. ^a	Commercial Harvest ^b	Number of Vessels	Crab per Pot	Ave Wt per Crab(lb)	Exvessel Price / lb.	Fishery Value (millions \$)
1976 ^{c&d}	8.1	-	-	-	-	-	-
1977 ^e	10.0	0.52	7	36	2.7	0.75	0.229
1978 ^e	11.0	2.09	8	64	3.0	0.95	1.897
1979 ^d	5.4	2.93	34	28	3.0	0.75	1.878
1980	6.6	1.19	9	29	3.6	0.75	0.890
1981	4.7	1.38	36	11	3.7	0.85	1.172
1982	1.3	0.23	11	6	3.6	2.00	0.405
1983	2.1	0.37	23	12	2.8	1.50	0.537
1984	2.7	0.39	8	14	2.8	1.02	0.395
1985	2.4	0.43	6	11	2.9	1.00	0.427
1986 ^f	2.8	0.48	3	38	2.9	1.25	0.600
1987 ^g	2.2	0.33	9	10	3.2	1.50	0.491
1988 ^h	3.2	0.24	2	32	3.1	ⁱ	ⁱ
1989	3.2	0.25	10	15	3.1	3.00	0.739
1990 ^b	3.2	0.19	4	19	3.1	ⁱ	ⁱ
1991 ^{c&d}	3.4	-	-	-	-	-	-
1992 ^d	3.4	0.07	27	4	3.0	1.75	0.130
1993 ^d	3.4	0.33	20	16	2.9	1.28	0.429
1994 ^{d,j}	3.4	0.32	34	9	3.0	2.02	0.646

^a Population estimate prior to fishery in given year in millions of pounds.

^b Millions of pounds.

^c No summer commercial fishery.

^d Population estimate derived by National Marine Fisheries Service.

^e Population estimate derived from commercial harvest data.

^f Population derived from 1985 ADF&G pot study.

^g Population estimate based on 1985 assessment survey data and recruitment of current assessment data; estimate probably low due to lack of recent data.

^h Population estimate based on 1988 NMFS post season trawl survey combined with summer fishery harvest.

ⁱ Data unavailable since all vessels were catcher/processors.

^j 85 boats made deliveries, 85 boats were registered, 52 permitted to be fished.

Appendix Table E4. Winter commercial and subsistence red king crab harvests, Norton Sound, Bering Sea, 1978-1994.

COMMERCIAL			SUBSISTENCE						
Year ^a	Number of Fishermen	# Crab Harvested	Winter ^b	Permits Issued	Permits Returned	Permits Fished	Total Crab Captured ^c	Total Crab Harvested ^d	Average Harvest/fm
1978	37	9,625	1977 -78	290	206	149	e	12,506	84
1979	1	221	1978 -79	48	43	38	e	224	6
1980	1	22	1979 -80	22	14	9	e	213	24
1981	0	0	1980 -81	51	39	23	e	360	16
1982	1	17	1981 -82	101	76	54	e	1,288	24
1983	5	549	1982 -83	172	106	85	e	10,432	123
1984	8	856	1983 -84	222	183	143	15,923	11,220	78
1985	9	1,168	1984 -85	203	166	132	10,757	8,377	63
1986	5	2,168	1985 -86	136	133	107	10,751	7,052	66
1987	7	1,040	1986 -87	138	134	98	7,406	5,772	59
1988	10	425	1987 -88	71	58	40	3,573	2,724	68
1989	5	403	1988 -89	139	115	94	7,945	6,126	65
1990	13	3,626	1989 -90	136	118	107	16,635	12,152	114
1991	11	3,800	1990 -91	119	104	79	9,295	7,366	93
1992	13	7,478	1991 -92	158	149	105	15,051	11,736	112
1993	8	1,788	1992 -93	88	79	37	1,193	1,097	30
1994	25	5,753	1993 -94	118	95	71	4,894	4,113	58

^a Prior to 1985 the winter commercial fishery occurred from January 1 thru April 30; as of March 1985, the winter commercial season was open by regulation from November 15 thru May 15.

^b The winter subsistence fishery occurs during months of two calendar years (as early as December, thru May).

^c The number of crab actually caught; some crab may have been released.

^d The number of crab "Harvested" is the number of crab caught and kept.

^e Data unavailable.

Appendix Table E5. Results of the population assessment surveys conducted for red king crab in Norton Sound since 1976.

Year	Date	Research Agency	Vessel	Gear Effort	Number of Red King Crab Captured ^a			Population Estimates of Legal Male Crab ^c	
					Sublegal Males	Legal ^b Males	Females	Numbers	Pounds
1976	9/02 - 9/05	NMFS	Miller-Freeman	Trawl	768	555	180	3,119,800	8,111,480
	9/16 -10/07			158 tows					
1979	7/26 - 8/05	NMFS	Miller-Freeman	Trawl	46	194	40	837,241	2,511,723
				71 tows					
1980	7/04 - 7/14	ADF&G	Altair	Pots	443	3,290	158	1,900,000	6,600,000 ^d
				397 lifts					
1981	6/28 - 7/14	ADF&G	Altair	Pots	4,097	3,415	1,933	1,285,195	4,755,221
				718 lifts					
1982	7/06 - 7/20	ADF&G	Aleutian #1	Pots	5,019	2,001	424	353,273	1,271,783
				689 lifts					
1982	9/05 - 9/11	NMFS	Miller-Freeman	Trawl	322	107	265	970,646	2,620,744
				50 tows					
1985	7/01 - 7/14	ADF&G	Arctic Sea	Pots	6,086	4,645	181	907,579	2,414,644
				642 lifts					
1985	9/16 -10/01	NMFS	Argosy	Trawl	266	163	151	1,203,000	3,369,000
				78 tows					
1988	8/16 - 8/30	NMFS	Miller-Freeman	Trawl	258	141	218	1,037,000	3,038,000
				82 tows					
1991	8/22 - 8/30	NMFS	Ocean Hope	Trawl	202	178	105	1,384,000	4,009,000
				53 tows					

^a Number of crab captured on ADF&G surveys represent data standardized for a 24 hour soak.

^b Legal male red king crab were defined as at least 106mm in carapace length for the 1976 NMFS survey; 105mm for the 1979 and 1985 NMFS survey; and at least 121mm in carapace width for all ADF&G surveys.

^c Population est. are valid for the date of the survey, ie either before or after the summer commercial fishery.

^d 1980 estimate has been revised from the original estimate of 13.4 million pounds. The original estimate was thought inaccurate due to under-reporting of tagged crab.

Appendix Table E6. Size composition by percent of red king crab from winter research pots near Nome, Norton Sound, Bering Sea, 1983-1994. ^a

Year	SUBLEGAL			LEGAL		
	Prerecruit Twos	Prerecruit Ones	Totals	Recruits	Post-Recruits	Totals
1983	26	38	64	26	10	36
1984	35	31	66	19	16	35
1985	25	45	70	20	10	30
1986	26	35	61	22	17	39
1987	13	31	44	11	45	56
1988 ^b	-	-	-	-	-	-
1989	27	15	42	27	31	58
1990	16	33	49	25	26	51
1991	5	30	35	34	31	65
1992 ^c	-	-	-	-	-	-
1993	3	9	12	17	71	88
1994 ^c	-	-	-	-	-	-

^a Sublegals = male crab less than 4 3/4" carapace width.

Pre-recruit Ones = Sublegals greater than 89mm in carapace length.

Pre-recruit Twos = Sublegals smaller than 90mm in carapace length.

Legals = male king crab greater than 4 3/4" carapace width.

Recruits = Legal new shell crab smaller than 116mm in carapace length.

Post-recruits = all non-recruit legal males.

^b No data collected in 1988 due to poor ice conditions.

^c No winter crab research study in 1992 or 1994.

SECTION 4: MISCELLANEOUS SPECIES
(Includes Norton Sound,
Port Clarence and Kotzebue Districts)

SECTION 4 - MISCELLANEOUS SPECIES

INTRODUCTION

Several species other than salmon, crab and herring are utilized for commercial and subsistence purposes in the Norton Sound, Port Clarence and Kotzebue Districts. Primary species include inconnu or "sheefish" (Stenodus leucichthys), whitefish (Coregonus laurettae, Coregonus pidschian, Coregonus sardinella, Coregonus nasus, and Prosopium cylindraceum). (Coregonus sp., Prosopium sp.), Dolly Varden (Salvelinus malma) and saffron cod (Eleginus gracilis).

The fish are taken by set gillnets, beach seines, "jigging" through the ice, and rod and reel. Subsistence catches taken during the summer months are normally air dried, while winter catches are stored frozen. Fish are utilized both for human consumption and for dog feed. Fish taken for commercial purposes are mainly sold locally, although some are shipped from the area.

Subsistence harvest of most species is not limited by regulation. Commercial harvest may be prohibited in some freshwater areas, but limited commercial endeavors are allowed in many areas under terms of a permit.

INCONNU (Sheefish)

Introduction

The distribution of inconnu includes the Kobuk-Selawik River drainages, and Hotham Inlet of Kotzebue Sound and some Norton Sound drainages, but the largest populations and harvests occur within the former area (Figure 21). In the Kotzebue Sound area, adult fish migrate to upriver spawning areas after ice breakup and to wintering areas within the Hotham Inlet/Selawik Lake area during October-November. Although inconnu are capable of consecutive spawning, most fish spawn every two to three years. Inconnu mature slowly with males reaching maturity at 5-7 years of age and females at 7-11 years.

The inconnu's spawning and overwintering migration behavior makes them available for harvest by the various fisheries throughout their life cycle, and increases their vulnerability to overharvest. In addition, the inconnu's slow maturation rate increases the time required to restore depleted populations.

During the 1960's, age, sex and length data indicated stocks were being overharvested by the commercial and subsistence fisheries in the Kotzebue district. Consequently, an annual area commercial harvest quota of 25,000 pounds of inconnu was instituted, although subsistence catches remained unrestricted.

Commercial Fishery

Most of the commercial fishing effort occurs near Kotzebue in Hotham Inlet. Fishermen use gillnets ranging from 5 1/2 inch - 7 inch stretched mesh which are set under the ice. Recorded commercial catches have remained relatively small; however, undocumented catches are believed to be significant and therefore, harvest totals should be considered minimum estimates. Restricted markets outside northwestern Alaska limits commercial activity greatly and most individuals who normally participate in the winter commercial fishery also fish for subsistence purposes. During some years, incidentally caught inconnu are also sold by commercial salmon fishermen when there is a market, but only in small amounts. No commercial harvest of sheefish was reported for 1993-1994 (Appendix Table F1).

Subsistence Fishery

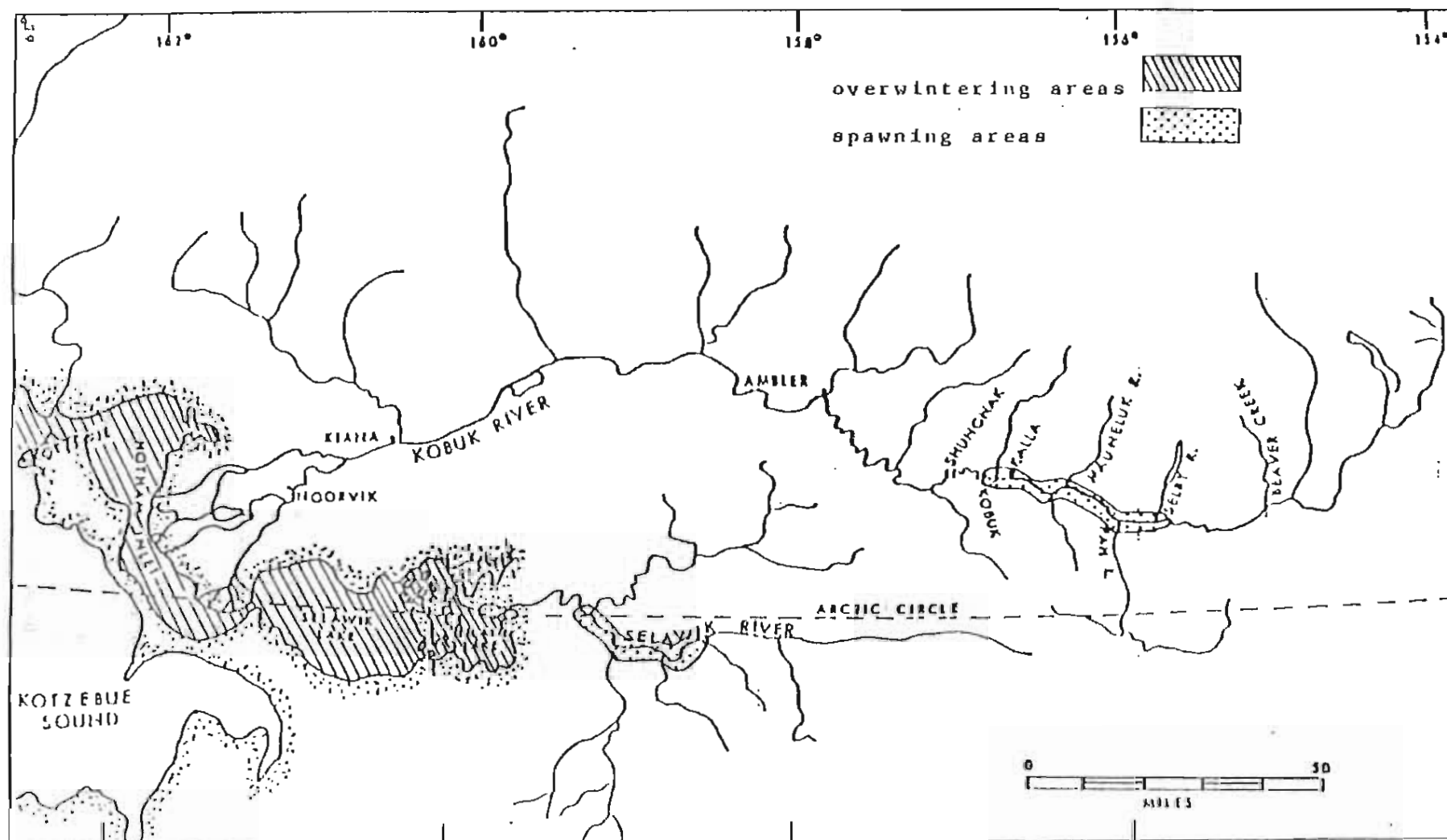
Inconnu have long been utilized for subsistence purposes throughout the Kotzebue Basin. Fishermen along the upper Kobuk River fish for inconnu during June through October, while the lower Kobuk and Selawik River residents fish during April through June. Kotzebue and Selawik fishermen fish in the Hotham Inlet and Selawik Lake during the winter months.

The 1994 winter subsistence harvests of inconnu in Kotzebue Sound and Selawik Lake were not estimated or surveyed. The Division of Subsistence assumed the annual survey responsibilities and did not question resource users about freshwater species.

Escapement

In recent years aerial surveys have been conducted on key inconnu spawning areas incidental to the effort of enumerating salmon. These surveys have primarily been conducted along the upper Kobuk River in September. Survey conditions historically result in either very few or no inconnu being observed (Appendix Table F3). During these surveys, species identification has been a problem in some years. Surveys were not conducted in 1985 through 1990 due to high, turbid water, poor weather conditions, or lack of personnel. Incomplete escapement and catch data provide little basis for assessing the current population status of inconnu in the Kotzebue district, however there is some local concern that the inconnu stocks are declining.

Figure 22. Kotzebue and Kobuk River Valley villages and their spatial relationship with Inconnu spawning and overwintering areas.



Appendix Table F.1. Kotzebue District winter commercial Sheefish harvest statistics, 1967 – 1994. ^a

Year ^b	No. of Fishermen	No. of Fish	Pounds		Price/ Pound	Estimated Value
			Total	Average		
1967 ^c		4,000	26,000	6.5	\$0.20	\$5,200
1968	10	792	4,752	6.0	\$0.22	\$1,045
1969	17	2,340	15,209	6.5	\$0.25	\$3,802
1970 ^c		2,206			\$0.14	
1971	4	73	720	9.9	\$0.13	\$95
1972	5	456	4,071	8.9	\$0.16	\$651
1973	11	2,322	15,604	6.7	\$0.20	\$3,121
1974	6	1,080 ^d	6,265	5.8	\$0.30	\$1,880
1975	^c	2,543 ^d	24,161	9.5	\$0.30	\$7,248
1976	14	2,633	19,484	7.4	\$0.30	\$5,845
1977	2	566	5,004	8.8	\$0.30	\$1,501
1978	11	2,879	26,200	9.1	\$0.40	\$10,480
1979 ^c						
1980	4	1,175	8,225	7.0	\$0.50	\$4,113
1981	1	278	1,836	6.6	\$0.75	\$1,377
1982	11	2,629 ^f	17,376	6.6	\$0.75	\$13,032
1983	8	1,424	13,395	9.4	\$0.50	\$6,698
1984	5	927 ^d	10,403	11.2	\$0.55	\$5,722
1985	4	342 ^d	3,902	11.4	\$0.51	\$1,990
1986	2	26	312	12.0	\$0.75	\$234
1987	3	670	5,414	8.1	\$0.49	\$2,653
1988	3	943	7,373	7.8	\$0.45	\$3,318
1989	8	2,335	16,749	7.2	\$0.51	\$8,542
1990 ^c	6	687	5,617	8.2		
1991	5	852	8,224	9.7	\$0.50	\$4,112
1992	3	289	2,850	9.9	\$0.65	\$1,853
1993	1	210 ^d	1,700	8.1	\$0.50	\$850
1994 ^c						

^a Data is not exact, in some instances total catch poundage was determined from average weight and catch data. Similarly, various price/pound figures were determined from price/fish and average weight data.

^b Season was from October 1 to September 30. Year indicated would be the year the commercial season ended. For example, the year 1980 would represent October 1, 1979 to September 30, 1980.

^c Data unavailable or incomplete.

^d Number of fish not always reported. Estimates were based on average weight from reported sales which documented the number of fish.

^e No reported commercial catches.

^f Estimate based on historical average weight.

Appendix Table F2. Reported subsistence inconnu catches, Kotzebue District, 1966-1994. ^{a,d}

Year	Number of Fishermen Interviewed	Reported Harvest	Average Catch per Fishermen
1966-67	135	22,400	166
1967-68	146	31,293	214
1968-69	144	11,872	82
1970	168	13,928	83
1971	155	13,583	88
1972	79	3,832	49
1973	65	4,883	75
1974	58	1,062	18
1975	69	1,637	24
1976	57	966	17
1977	95	1,810	19
1978	95	1,810	19
1979	75	3,985	53
1980	74	3,117	42
1981	62	6,651	107
5/82-4/83 ^{b,c}	130	4,704	36
5/83-4/84 ^{b,c}	27	764	28
5/84-9/84 ^b	30	2,803	93
1985 ^c	2	60	30
1986 ^{c,e}	72	721	10
1987 ^c	46	276	6
1988 ^{e,f}	-	-	-
1989 ^c	-	-	-
1990 ^c	-	-	-
1991	40	2,180	55
1992	43	2,821	66
1993	46	2,441	53
1994 ^c	-	-	-

^a To obtain individual village catches during years previous to 1982 refer to the 1982 Annual Management Report.

^b Catch by village for these years are presented in separate tables in respective year annual management reports.

^c Summer catches only; winter catches were not documented.

^d Due to limited survey effort during many years, total catch an effort should be regarded as minimum figures only and are not comparable year to year.

^e Villages were not surveyed for subsistence inconnu harvests from 1985; figures shown are catches reported during the fall chum salmon subsistence surveys, and may include summer as well as winter catches.

^f Subsistence inconnu catches not documented.

Appendix Table F3. Annual aerial survey counts of inconnu in the Kobuk and Selawik Rivers, 1966-1994.

Date	Kobuk River	Selawik River	Total
09/05/66	1,200	b	1,200
09/22/67	1,025	b	4,359
09/14/68	4,973	1,234	6,207
09/10/69	3,654	b	3,654
09/05/70	3,220	b	3,220
08/30/71	8,166	1,196	9,362
08/22/72	a	b	-
1973	b	b	-
08/21/74	a	b	-
08/24/75	a	b	-
09/02/76	73	b	73
1978	b	b	-
09/12/79	2,824	b	2,824
09/11/80	1,772	b	1,772
09/15/81	250 c	b	250
1982	a	b	a
09/19/83	1,009 c	b	1,009
09/05/84	2,604	b	2,604
1985	b	b	-
1986	b	b	-
1987	b	b	-
1988	b	b	-
1989	b	b	-
1990	b	b	-
1991	17,335	b	-
1992	3,310	b	-
1993	b	b	-
1994	b	b	-

a No fish reported.

b Not surveyed.

c Probably more inconnu than listed; species identification problems.

DOLLY VARDEN

Introduction

Dolly Varden (*Salvelinus malma*) are distributed throughout the Norton Sound, Port Clarence, and Kotzebue districts. Although taxonomists have disagreed on the distinguishing Dolly Varden characteristics and distribution of Arctic Char and Dolly Varden, most now agree that char in this area are the northern form of Dolly Varden. In order to eliminate confusion, in this report these fish will be referred to as Dolly Varden, the common name for this species complex.

Dolly Varden in this area are primarily nonconsecutive spawners and spawn throughout the late summer and fall. Fry emerge in the spring and migrate to the ocean during early summer after spending from 1 to 6 (generally 2-5) years in freshwater. Since Dolly Varden are a late-maturing fish (generally age 6-7), they are susceptible to overfishing by commercial, subsistence, and/or sport fisheries. Consequently, commercial fisheries have been maintained at low levels or prohibited to both reduce the potential of overharvest and provide for reproductive and subsistence fishery needs.

Commercial Fishery

Dolly Varden are taken as a non-target species in the directed Kotzebue commercial chum salmon fishery (Tables 9 and 10). Regulation changes in 1976, which closed the commercial salmon fishery on August 31, have reduced the harvest of Dolly Varden since Dolly Varden typically pass through the harvest area during September. Dolly Varden generally appear in commercial catches during the last three weeks of August (Table 19). Reported Dolly Varden catches are dependent upon available markets. The typical season catch when buyers are purchasing Dolly Varden is between 1,000 to 3,000 fish (Appendix Table F4). In 1994, 149 Dolly Varden were caught and sold during the commercial salmon fishery. The total weight was 767 pounds for a 5.1 pound average per fish and the average price was \$0.17 per pound. (***)The 1991 harvest was significantly higher at 6,136 due to a high Dolly Varden return with a strong pulse of fish that moved through the commercial fishery during an open period.(***) Historically two-thirds of the catch is taken on the north side of the district near Sisaulik. There were indications that a pulse of Dolly Varden moved through the district, but the fish were quite small and probably went through the commercial gear. What happened to the larger spawners is being investigated by the Division of Sport Fisheries.

There are several small quota (2,500 pounds) freshwater fisheries in Norton Sound but effort is inconsistent, varying from year to year and stream to stream. During 1994, fishermen from Unalakleet reported harvesting 4,814 pounds of char from the Unalakleet and Egavik Rivers at \$0.75 per pound. The average weight and fish count were not reported. Fishermen from Elim reported a harvest of 94 pounds of char from the Kwiniuk and Tubutulik Rivers at an average weight of 0.69 pounds per fish. There are no fish tickets or records to back these verbal reports

due to staffing problem at the buyer's office. These harvest reports are from weekly telephor conversations between the department's staff and the fish buyers.

Subsistence Fishery

Dolly Varden are an important component in the diet of subsistence users in the Norton Sound-Kotzebue Sound areas. Subsistence fishermen catch Dolly Varden with seines in the fall, hook and line through the ice in the winter, and gillnets in the spring. The fall seine fishery contributes the greatest number of fish to the annual subsistence Dolly Varden harvest. Since 1962, seine catches made by the residents of Kivalina, within the Kotzebue District, have ranged from 7,000 to 49,000 Dolly Varden annually (Appendix Table F5).

Fall seine fishing is a group effort with several households comprising a fishing group. The catch is stored and allowed to freeze in willow cribs located near the seining site. These fish are used throughout the winter by the fishing group. It should be pointed out that the historical subsistence Dolly Varden catches that are summarized in Appendix Table F5 are very minimal figures due to the timing of the surveys conducted. Most Dolly Varden harvest take place prior to or just after freeze-up. The village of Noatak usually fishes prior to freeze-up, while the Kobuk River villages of Shungnak and Noorvik fish for Dolly Varden throughout the winter.

Most villagers in the Norton Sound District report incidental catches of Dolly Varden in their subsistence salmon nets. However, the bulk of the catch is taken by seining in the late fall, after Department subsistence surveys had been completed which made it difficult to estimate subsistence catches in the Norton Sound District. Due to budget restrictions, no subsistence surveys were conducted in the fishing villages of Norton Sound since 1985.

Sport Fishery

Residents of the Kotzebue area and nonlocal residents on wilderness boating trips on the Kobuk and Noatak Rivers are the primary participants in the Dolly Varden sport fishery in the Kotzebue area watershed. Approximately 1,500 Dolly Varden are taken in this fishery annually (Sport Fish Division surveys).

Overwintering Counts

Aerial survey counts of overwintering Dolly Varden on the Wulik River have ranged from 297,257 Dolly Varden in 1969 to 30,923 Dolly Varden in 1984 (Appendix Table F6). Weather and water conditions have precluded flying aerial surveys during many years. When weather permits, the Division of Sport Fisheries conduct aerial surveys of the spawning grounds on the Noatak River in the summer and the overwintering areas of the Kivalina and Wulik Rivers in the fall. During the fall of 1994, 66,752 overwintering Dolly Varden were counted on a survey of the Wulik River

(Sport Fish Division survey). Additional surveys were not conducted on the Noatak and Kivalina Rivers as in previous years.

Table 19. Incidental Dolly Varden catches in the Kotzebue District commercial salmon fishery by fishing period, 1994.

Period	Dates	Hours Fished	Number of Fishermen	Dolly Varden		
				Number	Pounds	Avg. Wt.
19	8/22	9	10	79	416	5.3
20	8/23	9	5	8	56	7.0
21	8/24	12	7	62	295	4.8
Totals		30		149	767	4.7

Appendix Table F4.

Dolly Varden harvested incidentally during the commercial salmon fishery, Kotzebue District, 1966-1994.

Year	Number of Fish Sold	Estimated Total Catch ^g	Pounds Sold	Average Weight Pounds	Average Price per Pound
1966	3,325	^h		7-10	0.55 ^r
1967	367	^h	2,606	7.1	0.11
1968	3,181	^h	21,949	6.9	0.14
1969	1,089 ^a	^h	-	-	2.84 ^r
1970	2,095	^h	-	-	-
1971	3,828 ^b	^h	23,353	6.4	0.16
1972	7,746	^h	56,545	7.3	0.17
1973	640	^h	4,608	7.2	0.16
1974	2,605 ^c	^h	20,580	7.9	0.16
1975	-	^h	-	-	-
1976	-	^h	-	-	-
1977	-	^h	-	-	-
1978	1,229	^h	9,094	7.4	0.15
1979	2,523	^h	12,523	5.0	0.25
1980	3,049	^h	17,015	5.6	0.20
1981	3 ^e	^h	16	5.6	0.17
1982	3,447	^h	23,648	6.9	0.20
1983	190 ^e	845	1,108	5.8	0.20
1984	347 ^e	1,090	2,104	6.1	0.25
1985	454	3,600	3,177	7.0	0.25
1986	5 ^e	2,373	34	6.8	0.20
1987	1,261	^h	8,704	6.9	0.30
1988	752	^h	4,967	6.6	0.35
1989	3,093	^h	20,293	6.6	-
1990	604	^h	4,219	7.0	0.25
1991	6,136	^h	40,747	6.6	0.18
1992	1,977	^h	11,951	6.1	0.10
1993	76	^h	540	7.1	0.10
1994	149	^h	767	4.7	0.17

^a Includes 269 taken by permit.

^b Includes 179 taken by permit.

^c Includes 234 taken during commercial inconnu fishery.

^d Some data extrapolated from average reported weight.

^e Limited char market; many fish used at home or dumped.

^r Price per fish.

^g Estimate includes fish caught but not sold based on interview of fishermen.

^h Estimate of Dolly Varden caught (but not sold) not made.

Appendix Table F5. Fall subsistence catches of Dolly Varden documented in Kivalina and Noatak, 1959-1994.

Year	Kivalina		Noatak
	Number	Pounds	Number ^d
1959 ^a	34,240	85,600	-
1960 ^a	49,720	124,300	-
1962	-	-	27,623
1963	-	-	4,130
1968	49,512	120,214	^e
1969	64,970	152,750	32,350
1970	33,820	79,420	3,700
1971	29,281	68,518	5,320
1972	48,807	114,637	1,492
1973 ^b	-	-	-
1979	14,600 ^c	-	9,060
1980	-	-	7,220
1981	15,000-18,000 ^c	-	3,056
1982	18,438 ^e	-	2,676 ^{b,f}
1983	16,270 ^c	-	4,545
1984	12,000 ^c	-	2,542
1985	10,500 ^c	-	^g
1986	7,436 ^c	-	46 ^h
1987	^g	-	1,376 ^h
1988	^g	-	^g
1989	^g	-	^g
1990	^g	-	^g
1991	^g	-	4,814
1992	^g	-	4,395
1993	^g	-	4,275
1994			

^a From Saario, Doris J. and Brian Kessel, Environment of Cape Thompson Region, Alaska, published by the U.S. Atomic Energy Commission, 1966.

^b Storm and ice conditions prevented fall harvest.

^c Harvest data from Sport Fish Division survey.

^d No data available on poundage.

^e Harvest data from Stephen Braund and Associates.

^f Expanded estimate (see text on subsistence fishery in 1982 Annual Management Report).

^g Not surveyed.

^h Subsistence fishermen just beginning to seine at time of the survey.

Appendix Table F6. Aerial survey counts of overwintering Dolly Varden and summer spawner surveys in the Kotzebue District watershed, 1968-1994.

Year	Noatak River	Overwintering	
	Spawner Survey ^a	Wulik River ^{b,e}	Kivalina River ^{b,e}
1968	-	90236	27640
1969 ^b	-	297257	-
1976	-	68300	12600
1977 ^d	-	-	-
1978 ^d	-	-	-
1979	-	55030	15744
1980	-	113553	39692
1981	7922	101826	45355
1982	8275	65581	10932
1983	2924 ^c	^d	^d
1984	9130	30923	5474
1985	10979	-	-
1986	^f	5590	5030
1987	^f	^f	^f
1988	^f	80000 ^c	^f
1989	^f	56384	^f
1990	7261	^f	^f
1991	9605	126985	35275
1992	^f	135135	^d
1993	9560	144138	16534
1994	^f	66752	^f

^a Includes spawner count on the Kelly, Kugururok and Nimiuktuk Rivers, tributaries of the Noatak.

^b Overwintering counts conducted in September.

^c Incomplete survey.

^d Poor weather hampered/prevented survey.

^e Surveys conducted by Sport Fish Division since 1979.

^f Not surveyed.

WHITEFISH

Introduction

Although inconnu belong to the whitefish family, this section deals with several smaller species of the genera Coregonus and Prosopium. The genus Coregonus contains the "broad" and "humpback" whitefish or C. nasus and C. pidschian, respectively. In addition, three whitefish species known as "ciscoes" belong to this genera; ie., the least cisco (C. sardinella), Arctic cisco (C. autumnalis) and Bering cisco (C. laurettae). "Round" whitefish (Prosopium cylindraceus) are the sole representatives of the genus Prosopium in this area. All species normally spawn in the fall in freshwater.

Whitefish occur throughout most bodies of freshwater in the Norton Sound/Port Clarence/Kotzebue areas and can also be found in inshore marine waters at various times of the year.

Whitefish are harvested to a very limited extent by the commercial and sport fisheries within the area, but are uniformly important to the various subsistence fisheries. Recently, there has been increasing interest in commercial development of this resource, especially in the Kotzebue district.

Commercial Fishery

Limited commercial whitefish harvests have been allowed since statehood, normally under the auspices of a permit which delineated harvest levels, open areas, legal gear, etc. Commercial whitefish fisheries have generally been limited to large open water areas (e.g. Grantley Harbor in the Port Clarence district) or ocean waters. Beach seines have been stipulated as legal gear in some instances in order to reduce the number of incidental species taken. Little comparative commercial catch and effort data have been recorded, but harvest levels have historically been low. A majority of the commercial catches have been made in Golovin Bay within the Norton Sound District, in the Kuzitrin River of the Port Clarence District, and in Hotham Inlet and Selawik River in the Kotzebue District. The fish have been sold to local markets for human consumption, dog food, or more recently, crab bait.

In the Kotzebue District, no permit was issued to harvest Fresh water fish during 1994. No whitefish harvest was reported from the Kotzebue District.

A fishermen from the Port Clarence District reported selling 7,548 pounds of whitefish in four deliveries. The average price was \$0.65 per pound and the catch was hauled by truck to Nome where it was sold locally.

There was a single delivery from Unalakleet in the Norton Sound District which totaled 250 pounds and sold for \$0.65 per pound. Verbal reports indicate 7 deliveries totaling 344 pounds were made at Elim. The Elim fish averaged 1.5 pounds a piece. This brings the estimated Norton

Sound harvest to 594 pounds. Both the Norton Sound and Port Clarence whitefish were marketed in Nome as crab bait.

Subsistence Fishery

Whitefish have been taken mainly by beach seine or set gillnets. Catches are usually dried and used for human consumption or dog food. In some areas fish are "gutted" and dried early in the summer, while later in the summer the fish are filleted and dried with the eggs and viscera intact.

Subsistence catch enumeration is difficult since fishermen do not count fish individually, but by "tubs", "bags", "strings" or any other estimators of gross abundance. Additionally, many fish have been dried and consumed or stored in caches prior to the survey period. Reported subsistence harvests are the result of a limited and sporadic survey effort and should be regarded as minimum figures and not comparable from year to year. Recent and historical subsistence harvest figures for the Kotzebue district are presented in Appendix Table F7 by year.

Escapement

Whitefish escapements have not been monitored in the past, but there have been no indications from limited Department observations or fishermen interviews of declining populations.

Appendix Table F7. Subsistence whitefish catch and effort data, Kotzebue District, 1970-1994.^a

Year	Fishermen Interviewed	Number of Fish
1970		58,165
1971		36,012
1974-1976	^b	^b
1977		30,810
1978		77,474
1979	123	43,653
1980	67	49,106
1981	71	37,746
1982	^b	^b
1983	47	16,389
1984	79	28,614
1985 ^c	46	5,229
1986 ^d	72	11,854
1987 ^d	46	20,020
1988 ^e	38	14,000
1989	^b	^b
1990	^b	^b
1991 ^d	63	16,015
1992 ^d	66	17,485
1993 ^d	70	19,060
1994	^b	^b

^a Data unavailable prior to 1970. Systematic whitefish catch surveys have never been conducted in the area. This information was collected incidentally with late summer salmon surveys and probably represents only a small fraction of the catch made on a year round basis.

^b No survey data.

^c Data was expanded based on limited interviews and represents the approximate harvest of fishermen contacted in Kianna and Shungnak only. These figures should be considered very minimal.

^d Data represents harvest reported from interviews of subsistence fishermen in Shungnak, Noorvik, and Noatak only. Since not all fishermen were contacted and fishing was still occurring at the time of the survey, these figures should be considered minimal.

^e Data represents harvest reported during fall chum subsistence surveys in Noorvik and Shungnak only; most families still fishing.

SAFFRON COD

Saffron cod, or tomcod as they are called locally, are extensively utilized as a subsistence resource in the Norton Sound, Port Clarence and Kotzebue Districts. Tomcod are taken through the ice by jigging as well as with gillnets in open water.

There has never been an extensive commercial fishery on tomcod in the Norton Sound, Port Clarence or Kotzebue areas. During 1980, one fisherman caught and sold 89 pounds (98 tomcod) in the Nome Subdistrict. There were no commercial landings during 1982. In 1983, one Nome area fisherman caught and sold 2,548 pounds (4,348 tomcod) and in 1989 one fisherman sold 1,800 pounds locally. These fish were used for dog food, crab bait and human consumption. No commercial deliveries were reported in during 1984-1988.

Norton Sound Economic Development Corporation has provided a market for several fish species that had not been commercially utilized in the past. The need for crab bait was the primary factor in initiating the 1994 fishery at Unalakleet, where 1402 pounds were sold in seven deliveries in January and February.

MISCELLANEOUS FINFISH SPECIES

Other finfish species taken for subsistence in the Norton Sound-Port Clarence-Kotzebue area include: rainbow smelt (boreal smelt), capelin, northern pike, starry flounders, yellow fin sole, arctic flounder, Alaska plaice, grayling, burbot, Pacific herring in the Fall time, and halibut (Appendix G1).

Subsistence utilization of these species has been documented although effort and catch vary widely in scale and importance with locality. Some of these species are important to the subsistence community in certain localities during specific seasons of the year.

Rainbow smelt, like saffron cod, had a limited commercial harvest at Unalakleet. During the January, February and March of 1994, 631 pounds of rainbow smelt were reported sold in nine deliveries for bait. The smelt and cod harvests from Unalakleet both occurred from estuarine areas. The Smelt were reported to be higher in the water column than the cod. Either species could often be harvested from the same jigging site.

Burbot, or freshwater cod, have been sold intermittently in the past in the Kotzebue, Port Clarence and Norton Sound Districts. During 1994, a single delivery of 310 pounds sold at \$0.50 was reported from Unalakleet.

Appendix G1. List of common and scientific names of finfish species of the Norton Sound, Port Clarence, and Kotzebue Districts.

Arctic lamprey	<i>Lampetra japonica</i>
Arctic char	<i>Salvelinus alpinus</i>
Arctic cod	<i>Boreogadus saida</i>
Arctic flounder	<i>Liopsetta glacialis</i>
Arctic grayling	<i>Thymallus arcticus</i>
Alaska plaice	<i>Pleuronectes quadrituberculatus</i>
Burbot	<i>Lota lota leptura</i>
Bering cisco	<i>Coregonus laurettae</i>
Bering poacher	<i>Ocella dodecaedria</i>
Bering wolffish	<i>Anarhicas orientalis</i>
Blackfish	<i>Dallia pectoralis</i>
Boreal smelt (rainbow-toothed)	<i>Osmerus epselanus</i>
Broad whitefish	<i>Coregonus nasus</i>
Capelin	<i>Mallotus villosus</i>
Dolly Varden	<i>Salvelinus malma</i>
Pond smelt	<i>Hypomesus olidus</i>
Humpback whitefish	<i>Coregonus pidschian</i>
Inconnu (sheefish)	<i>Stenodus leucichthys</i>
Lake trout	<i>Salvelinus namaycush</i>
Least cisco	<i>Coregonus sardinella</i>
Longhead dab	<i>Liranda proboscidea</i>
Ringtail snailfish	<i>Liparis rutteri</i>
Northern pike	<i>Esox lucius</i>
Longnose sucker	<i>Catostomus</i>
Pricklebacks	<i>Stichaeidae</i>
Pacific herring	<i>Clupea harengus pallasi</i>
Rock flounder	<i>Lepidostetta bilineata</i>
Rock greenling (terpug)	<i>Hexagrammus lagocephalus</i>
Round whitefish	<i>Prosopium cylindraceum</i>
Sculpins	<i>Cottidae</i>
Pink salmon	<i>Oncorhynchus gorbuscha</i>
Chum salmon	<i>Oncorhynchus keta</i>
Coho salmon	<i>Oncorhynchus kisutch</i>
Sockeye salmon	<i>Oncorhynchus nerka</i>
Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Saffron cod	<i>Eleginus gracilis</i>
Starry flounder	<i>Platichthys stellatus</i>
Sandlance	<i>Amrodytes hexapterus</i>
Sturgeon poacher	<i>Agonus acipenserinus</i>
Threespine stickleback	<i>Gasterosteus aculeatus</i>
Ninespine stickleback	<i>Pungitius</i>
Tubenose poacher	<i>Pallasina barbata</i>
Whitespotted greenling	<i>Hexagrammus stelleri</i>
Yellowfin sole	<i>Limanda aspera</i>

Appendix G2. Studies conducted within the Norton Sound, Port Clarence, and Kotzebue Districts, 1994.

Kwiniuk River Salmon Counting Tower

- a) Location: About five miles upstream from the mouth of the Kwiniuk River in Norton Sound.
- b) Objectives: Determine daily and seasonal timing and magnitude of chum and pink salmon runs. Determine age, sex and size of chinook and chum salmon of the commercial harvest in Moses Point Subdistrict and in the Kwiniuk River escapement.
- c) Results: The 1994 total expanded tower count: 627 chinook, 2,303,112 pink, 33,010 chum and 2,841 coho.

Unalakleet Salmon Escapement Studies

- a) Location: Unalakleet River
- b) Objective: To maintain an index of salmon migration up the Unalakleet River using test gill nets.
- c) Results:
 - 1) The mean day of catch for chinook, chum, pink, and coho salmon was 6/22, 7/7, 7/14, and 8/20, respectively. The peak daily catch of chinook, chum, pink, and coho salmon occurred on 6/16, 7/9, 7/14, and 8/22 respectively.
 - 2) The predominant age class in the test fish catch by the European aging method, by species was: chinook salmon 1.3 (age 5), chum salmon 0.4 (age 5) and coho salmon 2.1 (age 4).
 - 3) The predominant age class in the commercial catch by the European aging method, by species was: chinook salmon 1.3 (age 5), chum salmon 0.3 (age 4) and coho salmon 2.1 (age 4).

Nome River Salmon Counting Tower

- a) Location: Nome River, Approximately 4 miles east of Nome.
- b) Objectives:
 - 1) To determine daily and seasonal timing and magnitude of the spawning salmon runs.
 - 2) Compare aerial survey totals with tower counts in order to improve survey accuracy.

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- 3) A secondary objective as time and personnel allows would be to collect age and sex data through escapement sampling of subsistence catches, beach seining or possibly carcass sampling.

c) Results: The 1994 total expanded tower count: 41 chinook, 2,969 chum, 142,604 pink, 1,283 coho, and 170 Dolly Varden.

Kobuk River Test Fish Project

a) Location: Lower Kobuk River

- b) Objectives:
- 1) To evaluate the feasibility of indexing chum salmon escapement in the Kobuk River using systematic drift gill net catches.
 - 2) Describe the migratory timing of chum salmon in the Kobuk River.
 - 3) Sample for age, sex, and size data.

c) Results:

- 1) Fishing began on July 13 and continued through August 29.
- 2) A total of 624 chum salmon were caught in a total of 124 drift time periods.
- 3) Scale sample analysis from chum salmon caught in test drift nets indicated an age composition of 3.0% 0.2 (age 3), 58.0% 0.3 (age 4), 36.6% 0.4 (age 5), 2.4% 0.5 (age 6).

Noatak River Sonar

a) Location: Lower Noatak River

b) Objectives: Monitor salmon passage at the sonar station which estimates chum salmon, pink salmon, and Dolly Varden abundance and passage timing. Project sampling apports species of salmon and provides age composition relative to abundance and timing.

c) Results:

- 1) The total chum salmon passage estimate was 161,500, the Sikusuilaq Hatchery estimate was 45,000-50,000 chum, and the wild stock passage estimate was 111,500-116,500 during sonar operation.
- 3) Scale sample analysis from 1,160 chum salmon caught in test nets indicated an age composition of 3.1% 0.2 (age 3), 68.5% 0.3 (age 4), 26.8% 0.4 (age 5), 1.6% 0.5 (age 6).

Subsistence Fishing Surveys

- a) Location: Norton Sound, Port Clarence, and Kotzebue Districts.
- b) Objectives: Determine subsistence utilization of salmon for formulating management procedures and goals. House-to-house surveys were conducted in the Norton Sound, Port Clarence, and Kotzebue District surrounding villages by the State of Alaska Division of Subsistence. Subsistence salmon permits were issued in the Nome Subdistrict while the city of Kotzebue had no subsistence salmon harvest investigations in 1994.
- c) Results:
 - 1) A total of 1,169 households were surveyed in the Kotzebue District villages and the total reported chum salmon harvest was 35,261 fish (does not include Kotzebue).
 - 2) A total of 127 households were surveyed in the Port Clarence District villages and the total reported salmon harvest was 161 chinook, 1,818 chum, 3,440 pink, 1,765 sockeye, and 1,513 coho.
 - 3) A total of 667 households were surveyed in the Norton Sound District villages including Nome. The total reported salmon harvest was 5,335 chinook, 18,315 chum, 58871 pink, 860 sockeye, and 16,602 coho.
 - 4) A total of 141 permits were issued for the Nome Subdistrict of Norton Sound in 1994 and 129 permits were returned. Their reported catches totaled 22 chinook, 99 sockeye, 6,065 pink, 1,575 chum, and 1,044 coho salmon.

Commercial Catch Sampling

- a) Locations: Norton Sound, Port Clarence and Kotzebue Sound.
- b) Objective: Obtain age, sex, and size information for commercially caught herring, salmon and king crab.
- c) Results: Approximately 1,310 herring, 4,580 salmon, and 1,385 king crab were sampled in 1994. These data are being analyzed and will be presented in separate reports.

Herring Test Fishing

- a) Location: Norton Sound ocean waters; camps located at Cape Denbigh and Klikitarik; a third test fish crew operated out of Unalakleet.
- b) Objectives: To determine age class composition of the Norton Sound herring return through test fishing with variable mesh gill nets.

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- c) Results: Gill nets were operated from May 16 through June 15. Scale analysis of test fish catches has been completed; results are listed in Figure 13.

Nearshore Winter King Crab Study

- a) Location: Ocean waters of Norton Sound 1 to 2.5 miles south of Nome.
- b) Objective: To observe the abundance and distribution of red king crab in nearshore Nome waters. Also to evaluate the effectiveness of the "15 mile summer commercial crab closure" in protecting inshore crab; to obtain basic life history data.
- c) Results: Project did not operate due to lack of funding in 1994.

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-S-1-94	June 20, 1994 6:00 p.m. ADT	This emergency order opens the Shaktoolik and Unalakleet Subdistricts to commercial king salmon fishing for the standard 24 hour periods beginning at 6:00 p.m. Monday, June 20 through July 1. The fishing periods will run from 6:00 p.m. Monday until 6:00 p.m. Tuesday and from 6:00 p.m. Thursday until 6:00 p.m. Friday. Only nets with a mesh size of seven and one-half inches or larger will be allowed.	Subsistence catch data and the Unalakleet test fishing data both indicate the king salmon migration is now moving into the rivers. King salmon have been present in nearshore waters for at least ten days. King salmon catches have been gradually increasing in the Unalakleet River for the past six days. Chum salmon catches in the Unalakleet test net the past two days are high. This indicates a good start on both chum and king escapement. Pink salmon are also beginning to show in the catches, which tends to confirm the expectations of a strong pink salmon return during early July. Pink salmon directed openings are anticipated after July 1. Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.
3-Z-S-2-94	June 28, 1994 6:00 a.m. ADT	This emergency order closes the Nome Subdistrict to subsistence salmon fishing in the Sinuk, Cripple, Penny, Snake, Nome, Flambeau, Eldorado, Bonanza, and Solomon Rivers. In addition, the waters of Safety Sound and Bonanza Channel inside the barrier spit and Safety Bridge, as well as ocean waters from the Cape Nome jetty west to the Sinuk River mouth are closed to salmon fishing from 6:00 p.m. June 20 through July 30.	During the four year period, 1987 to 1990 salmon escapements in the immediate Nome area were well below historic levels and the levels the department staff believes are needed to maintain the salmon runs. This is particularly true of the chum salmon stocks. During 1991, 1992 and 1993, the trend of declining chum salmon escapements was broken. Many streams in the Nome area were judged to have adequate chum escapement levels. A similar management technique to what was used in 1992 is planned for the 1994 season. Subsistence fishing will reopen as pink salmon become abundant and as chum escapement goals are met. Various locations and streams will be judged individually and opened on the basis of their individual chum salmon escapement and pink salmon abundance. The staff will be flying frequent surveys and boating some of the rivers to track the salmon migration's strength and progress. If a stream appears to have adequate escapement, restrictions will be lifted in that area; otherwise, the restrictions will remain in place until they no longer benefit the species of concern.

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-2-S-3-94	12:00 noon ADT June 26, 1994	This emergency order opens portions of the Shaktoolik and Unalakleet Subdistricts to pink salmon fishing beginning at 6:00 p.m. Sunday and closing at 12:00 noon Monday. In the Shaktoolik Subdistrict, the waters from the Shaktoolik River to the point where the bluff starts at the Foothills will be open. In the Unalakleet Subdistrict, the waters from Egavik River mouth to the tip of Black Point will be open. Gill net mesh size will be limited to four inches from the Unalakleet River north and from the Unalakleet south gill net mesh size will be limited to four and one-half inches or smaller.	<p>The pink salmon migration reached nearshore waters early last week. A harvestable surplus is thought to exist now. An eighteen hour test opening will be allowed to check the impact of a pink targeted fishery and allow the processor to tune up his production line. Escapement indices, incidental harvest rates, and total pink salmon harvest will be the points of interest. The findings on these points will influence future decisions.</p> <p>The king salmon opening scheduled to begin Monday evening will occur as scheduled. The next pink salmon directed opening will not occur before Wednesday morning.</p>
3-2-S-4-94	June 29, 1994 6:00 a.m. ADT	This emergency order opens portions of the Shaktoolik and Unalakleet Subdistricts to pink salmon fishing beginning at 6:00 a.m. Wednesday, until further notice. In the Shaktoolik Subdistrict, the waters from the Shaktoolik River to the point where the bluff starts at the Foothills will be open. In the Unalakleet Subdistrict, the waters from Egavik River mouth to the tip of Black Point will be open. Gillnet mesh size will be limited to four inches from the Unalakleet River north and from the Unalakleet south gillnet mesh size will be limited to four and one-half inches or smaller. Drifting of gillnets will be allowed during this pink salmon opening.	<p>The pink salmon test opening that occurred Sunday night was quite successful. The harvest of pink salmon was very high considering the early date. The incidental chum salmon harvest on the other hand was surprisingly low, with an average of one chum caught for every 250 pink salmon. The test opening indicates an abundance of pink salmon of high quality and a minimal incidental impact on chum salmon. An opportunity to harvest the abundant pink salmon resource at its peak value has presented itself. This emergency order is intended to take full advantage of that opportunity.</p> <p>The rate of harvest was all the processor could handle in such a short period. By allowing unrestricted fishing time, the buyer will have to set the buying schedule to meet their capacity. Fishermen should check with the buying stations prior to fishing to assure themselves of a market.</p> <p>The area restrictions are intended to direct the fishing effort toward pink salmon and away from chum salmon which have had weak returns in recent years. Drifting of gillnets is allowed to facilitate pink salmon fishing during periods of poor weather, wood in the water, or situations where a fishing vessel is attempting to follow a school of salmon.</p> <p>There will be no more king salmon openings scheduled during the 1994 season. King salmon appear to have reached their peak and will be declining in number. Additional king openings would result in a loss of opportunity to harvest pink salmon, which by abundance will more than compensate in value for the early closure of king salmon.</p>

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-S-5-94	June 30, 1994 6:00 p.m. ADT	This emergency order opens the Shaktoolik and Unalakleet Subdistricts to commercial king salmon fishing for a standard 24 hour period beginning at 6:00 p.m. Thursday, June 30 until 6:00 p.m. July 1. The fishing period will run simultaneously with the pink opening in progress. Nets with a mesh size of seven and one-half inches or larger and pink salmon mesh sizes as described in emergency order 3-Z-S-4-94 will be allowed. No permit holder will be allowed to operate more than 100 fathoms of gillnet.	Subsistence catch data and the Unalakleet test fishing data both indicate the king salmon migration is of at least average strength. Commercial king salmon harvests are also roughly normal for this date, but chum salmon harvests are only 20% of normal due to the gear restrictions that have been in place. Chum salmon in the Unalakleet River as measured by the test fishing project indicate a strong escapement. Chum escapement at the Kwiniuk Tower is on track to meet the escapement goal there on roughly July 20. The incidental chum harvests of either the pink or king directed openings has been very small and are of little consequence to the impacted chum stocks. An opening of mixed gear types will allow fishermen to continue a limited harvest of king salmon as has been the practice in the past, while allowing those who wish to harvest the more abundant pink salmon to do so. Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.
3-Z-S-6-94	July 4, 1994 6:00 p.m. ADT	This emergency order opens the ocean waters of the Nome Subdistrict to subsistence salmon fishing. The fresh water areas will remain closed including: the Sinuk, Cripple, Penny, Snake, Nome, Flambeau, Eldorado, Bonanza, and Solomon Rivers. In addition, the waters of Safety Sound and Bonanza Channel inside the barrier spit and Safety Bridge are closed through July 30.	The pink salmon migration has been moving into the river mouths and estuarine areas for several days. The strong pink salmon run in eastern Norton Sound indicates pink salmon are abundant in offshore waters. The sheer abundance of pinks is expected to limit the harvest of chum salmon. This is the first step of a three step relaxation process of the closure announced earlier this year. A similar management technique to what was used in 1992 is planned for the 1994 season. Subsistence fishing will reopen as pink salmon become abundant and as chum escapement goals are met. Various locations and streams will be judged individually and opened on the basis of their individual chum salmon escapement and pink salmon abundance. The staff will be flying frequent surveys and boating some of the rivers to track the salmon migration's strength and progress. If a stream appears to have adequate escapement, restrictions will be lifted in that area; otherwise, the restrictions will remain in place until they no longer benefit the species with escapement concerns.

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-S-7-94	July 4, 1994 6:00 p.m. ADT	This emergency order opens the Shaktoolik and Unalakleet Subdistricts to commercial king salmon fishing for a standard 24 hour period beginning at 6:00 p.m. Monday, July 4 until 6:00 p.m. Tuesday, July 5. The fishing period will run simultaneously with the pink opening in progress. Nets with a mesh size of seven and one-half inches or larger and pink salmon mesh sizes as described in emergency order 3-Z-S-4-94 will be allowed. No permit holder will be allowed to operate more than 100 fathoms of gillnet.	Subsistence catch and the Unalakleet test fishing data both indicate the king salmon migration is of at least average strength. Commercial king salmon harvests are also roughly normal for this date, but chum salmon harvests are only 10% of normal due to the gear restrictions that have been in place. Chum salmon in the Unalakleet River as measured by the test fishing project indicate a strong escapement. Chum escapement at the Kwiniuk Tower is on track to exceed the escapement goal there. The incidental chum harvests of the last king directed opening was roughly one-half the king harvest and was of little consequence to the chum stocks. An opening of mixed gear types will allow fishermen to continue a limited harvest of king salmon as has been the practice in the past, while allowing those who wish to harvest the more abundant pink salmon to do so. Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.
3-Z-S-8-94	July 7, 1994 6:00 p.m. ADT	This emergency order opens the Shaktoolik and Unalakleet Subdistricts to commercial chum salmon fishing for a 48 hour period beginning at 6:00 p.m. Thursday, July 7 until 6:00 p.m. Saturday, July 9. The fishing period will run simultaneously with the pink opening in progress. Nets with a mesh size of six inches or smaller and pink salmon mesh sizes as described in emergency order 3-Z-S-4-94 will be allowed. No permit holder will be allowed to operate more than 100 fathoms of gillnet.	The commercial chum salmon harvest is only 10% of normal due to previous gear restrictions that have been in place. Chum salmon in the Unalakleet River as measured by the test fishing project indicates a strong escapement. Chum escapement at the Kwiniuk Tower is expected to exceed the escapement goal in less than a week at the present passage rate which is well ahead of schedule. In addition, the incidental chum harvest during both the pink and king directed fishing periods has been very small. Therefore, an opening of mixed gear types will test the willingness of fish buyers to purchase chum salmon, while allowing those fishermen who wish to harvest the more abundant pink salmon to do so. Markets and harvests of incidental species will be considerations in determining when additional fishing periods should occur. Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-S-9-94	July 8, 1994 6:00 p.m. ADT	This emergency order opens the portion of Subdistrict 5 from the Shaktoolik River to Cape Denbigh, in addition to the portions of the Shaktoolik and Unalakleet Subdistricts already open to pink salmon fishing, until noon July 20. In the Shaktoolik Subdistrict, the waters from the Cape Denbigh to the point where the bluff starts at the Foothills will be open. In the Unalakleet Subdistrict, the waters from Egavik River mouth to the tip of Black Point will be open. Gillnet mesh size will be limited to four inches from the Unalakleet River north and from the Unalakleet south gillnet mesh size will be limited to four and one-half inches or smaller. Drifting of gillnets will be allowed during this pink salmon opening.	Pink salmon fishermen have requested the sheltered waters east of Cape Denbigh be opened to pink salmon fishing. This area was closed to direct fishing away from an area thought to intercept some chum salmon. The incidental catch rates of chum in the pink salmon fishery have generally been less than one chum to 1000 pink salmon. Chum salmon escapement goals are thought to be assured in Subdistricts 3 through 6. The earlier closure is no longer needed and now only impedes the harvest of a near record pink salmon return.
3-Z-S-10-94	July 11, 1994 6:00 p.m. ADT	This emergency order opens the Nome River down stream of the VOR site, the Sinuk River, the Bonanza River, and the Solomon River to subsistence beach seining of pink salmon. Only the normally open areas in these rivers will be open for beach seining, and closed areas will be marked with signs. All chum salmon caught in beach seines must be released. The Cripple, Penny, Snake, Nome River upstream of the VOR, Flambeau, and Eldorado Rivers will remain closed. The waters of Safety Sound and Bonanza Channel down stream of the confluence of the Eldorado and Flambeau Rivers are now open to beach seining.	The pink salmon migration has been moving into the river mouths and estuarine areas for over a week. The strong pink salmon run in eastern Norton Sound indicates pink salmon are abundant in offshore waters. The sheer abundance of pinks is expected to limit the harvest of chum salmon. This is the second step of a three step relaxation process of the closure announced earlier this year. A similar management technique to what was used in 1992 is planned for the 1994 season. Subsistence fishing will reopen as pink salmon become abundant and as chum escapement goals are met. Various locations and streams will be judged individually and opened on the basis of their individual chum salmon escapement and pink salmon abundance. The staff will be flying frequent surveys and boating some of the rivers to track the salmon migration's strength and progress. If a stream appears to have adequate escapement, restrictions will be lifted in that area; otherwise, the restrictions will remain in place until they no longer benefit the species with escapement concerns.

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-S-11-94	July 20, 1994 12:00 noon ADT	This emergency order extends the opening in those portions of the Shaktoolik and Unalakleet Subdistricts already open to pink salmon fishing, until 6:00 p.m. Saturday July 23. In the Shaktoolik Subdistrict, the waters from the Cape Denbigh to the point where the bluff starts at the Foothills will be open. In the Unalakleet Subdistrict, the waters from Egavik River mouth to the tip of Black Point will be open. Gillnet mesh size will be limited to four inches from the Unalakleet River north and from the Unalakleet south gillnet mesh size will be limited to four and one-half inches or smaller. Drifting of gillnets will be allowed during this pink salmon opening.	Pink salmon catches have been dropping for several days. The availability of pink salmon in nearshore waters is rapidly declining and reported to be low in the vicinity of Moses Point. The Kwiniuk tower salmon counts indicate there was surge in the movement of pink into freshwater late last week. It now appears the abundance of pinks in saltwater in other subdistricts is declining as well. Fish quality is dropping also. The quality and quantity of pink salmon is not expected to carry a commercial fishery beyond Saturday in any Norton Sound subdistrict.
3-Z-S-12-94	July 25, 1994 6:00 p.m. ADT	This emergency order opens the Shaktoolik and Unalakleet Subdistricts to commercial silver salmon fishing for the standard two 48 hour periods per week beginning at 6:00 p.m. Monday, July 25 until the normal season ends, 6:00 p.m. Wednesday, September 7. Nets with a mesh size of six inches or smaller will be allowed. Normal Subdistrict boundaries will be in effect for the remainder of the season.	The abundance of pink salmon is rapidly declining in ocean waters in both the Unalakleet and Shaktoolik Subdistricts. The abundance of silver salmon in the Unalakleet River and near shore waters is relatively high for so early in the season. The incidental harvests of silver salmon outnumber the incidental harvest of chum salmon in the recent pink salmon openings. With the strong showing of silver salmon and far more than adequate escapements of both chum and pink salmon there is no reason to delay the coho salmon fishery in eastern Norton Sound.
3-Z-S-13-94	July 25, 1994 6:00 p.m. ADT	This emergency order opens the Moses Point Subdistrict to commercial silver salmon fishing for the standard two 24 hour periods per week beginning at 6:00 p.m. Monday, July 25 until the normal season ends, 6:00 p.m. Wednesday, August 30. Nets with a mesh size of six inches or smaller will be allowed.	The abundance of pink salmon is rapidly declining in ocean waters in the Moses Point Subdistrict. The abundance of silver salmon in the near shore waters is relatively high for so early in the season. The incidental harvests of silver salmon outnumber the incidental harvest of chum salmon in the recent pink salmon openings. With the strong showing of silver salmon and far more than adequate escapements of both chum and pink salmon there is no reason to delay the coho salmon fishery in eastern Norton Sound.

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-S-14-94	July 28, 1994 6:00 p.m.ADT	This emergency order opens the Eldorado and Flambeau Rivers along with Safety Sound and Bonanza Channel to subsistence beach seining of pink salmon and subsistence gillnet fishing for all species. All chum salmon caught in beach seines must be released. The Cripple, Penny, Snake, and Nome River upstream of the VOR will remain closed.	The Chum salmon escapement goals for the Eldorado and Flambeau Rivers are now thought to have been met. Both pink and chum salmon numbers have recovered to some extent from their low parent year returns. The bulk of the salmon in both these watersheds are now out of reach of subsistence fishers. However, there are several families interested in a late season harvest of either chum or pink salmon. The remaining streams in the Nome area are not doing as well with chum escapement. The other streams will be opened once the chum salmon run is judged to be over.
3-Z-S-15-94	August 1, 1994 6:00 p.m. ADT	This emergency order opens the Nome Subdistrict to a standard salmon fishing schedule of two 24 hour periods each week beginning at 6:00 p.m. Monday and closing at 6:00 p.m. Tuesday and opening at 6:00 p.m. Thursday and closing at 6:00 p.m. Friday.	Two commercial fishermen have requested they be allowed to commercially harvest silver salmon in the Nome Subdistrict. The silver salmon return is expected to be strong during 1994. The Nome River tower indicates that the silver salmon migration now exceeds the chum run. Although the harvestable surplus must support a subsistence and sport harvest, it is thought that a limited commercial harvest could be allowed as well. Should either the escapement or subsistence harvests be judged to be inadequate, this commercial season will be closed.
3-Z-S-16-94	August 1, 1994 6:00 p.m.ADT	This emergency order opens the Golovin Bay and Norton Bay Subdistricts to commercial silver salmon fishing for the standard two 48 hour periods per week beginning at 6:00 p.m. Monday, August 1 until 6:00 p.m. Wednesday, August 30. Nets with a mesh size of six inches or smaller will be allowed.	The abundance of silver salmon in the nearshore waters is relatively high for so early in the season. The harvests of silver salmon out number the incidental harvest of chum salmon in the recent salmon openings in Subdistricts 3, 5 and 6. With the strong showing of silver salmon and far more than adequate escapements of both chum and pink salmon, there is no reason to delay the coho salmon fishery in Norton Sound.
3-Z-S-17-94	August 1, 1994 6:00 p.m.ADT	This emergency order extends the Moses Point Subdistrict west to Canyon Creek near the Portage Roadhouse.	The local fishermen and the buyer have expressed an interest in moving their fishery away from the mouths of the rivers in order to avoid water marked salmon. The area that has been extended has no significant salmon producing streams and is believed to be an area where the salmon bound for the rivers of the subdistrict migrate. Canyon Creek is roughly eight miles from Cape Darby, so this extension is not expected to affect salmon stocks bound for Golovin Bay.
3-Z-S-18-94	August 2, 1994 6:00 p.m.ADT	This emergency order extends fishing time in the Moses Point Subdistrict to the standard two 48 hour periods per week beginning at 6:00 p.m. Monday until 6:00 p.m. Wednesday and from 6:00 p.m. Thursday until 6:00 p.m. Saturday through August 30.	The abundance of silver salmon in the nearshore waters remains high. The harvests of silver salmon far out number the incidental harvest of chum salmon in the recent salmon openings in Subdistrict 3. The counting tower on the Kwiniuk River indicates a strong escapement of coho salmon has already begun. The recent storm should further enhance escapement. With the strong showing of silver salmon and a good start on escapement, an increased rate of harvest can be allowed.

Appendix G3. Emergency orders issued during 1994.

Emergency Order Number	Effective Date	Action Taken	Comments
3-2-S-19-94	August 8, 1994 6:00 p.m. ADT	This emergency order opens the Solomon, Bonanza, Sinuk and Nome Rivers to subsistence gillnet fishing for all species. This emergency order closes beach seining in the Nome River. Beach seines are still legal gear in portions of the streams east of Cape Nome and the Sinuk River. All chum salmon caught in beach seines must be released. The Cripple, Penny, Snake, and Nome River upstream of the VOR will remain closed to subsistence fishing.	The silver salmon escapement in the Nome River is lagging well behind the escapement observed last year. The escapements of the Snake and Cripple Rivers are also thought to be poor. Typically, silver salmon run in pulses associated with storm events and high tides. After several such events, we have yet to see any significant escapement in the local streams. A fairly intense level of harvest has been observed on the Nome, Snake, and Cripple Rivers. This action is intended to direct fishing away from the streams most easily accessed from Nome while allowing normal harvest periods within reach of Nome residents.
3-2-S-20-94	August 13, 1994 6:00 p.m. ADT	This emergency order extends fishing time in the Norton Bay, Moses Point, and Golovin Bay Subdistricts to an uninterrupted seven day per week fishing schedule.	The silver salmon escapements in these three subdistricts is thought to be above average for this point in the run. There are no longer any other significant salmon runs to consider in these subdistricts. Participation in the commercial fisheries along the northern shores of Norton Sound has been minimal. Weather and a decline in salmon markets in recent years have played a role in the low commercial fishing effort this year. No harvests have been reported from Norton Bay in the last two weeks and less than half the historic numbers of fishermen are participating in the Moses Point and Golovin fisheries. Uninterrupted fishing is now possible since escapement needs will be met with this low level of fishing effort.
3-2-S-21-94	August 31, 1994 6:00 p.m. ADT	This emergency order extends the fishing season in the Norton Bay, Moses Point, and Golovin Bay Subdistricts to 6:00 p.m. September 7.	The silver salmon escapements in these three subdistricts are thought to be above average for this point in the run. There are no longer any other significant salmon runs to consider in these subdistricts. Participation in the commercial fisheries along the northern shores of Norton Sound has been minimal. No harvests have been reported from Norton Bay this season and less than half the historic numbers of fishermen are participating in the Moses Point and Golovin fisheries. Water levels have been high in these Subdistricts, but not to the point that fish survival is thought to be a problem. Because escapement is judged to be adequate and fishing effort is low, an additional week's harvest can be allowed.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-S-22-94	August 31, 1994 6:00 p.m. ADT	This emergency order extends commercial silver salmon fishing in the Shaktoolik and Unalakleet Subdistricts to seven days per week beginning at 6:00 p.m. Wednesday, August 31 until the normal season ends, 6:00 p.m. Wednesday, September 7.	The silver salmon run strength is judged to be above average. Commercial catch statistics during late July and early August were well above average. Escapement appears to be above average on the basis of the test net catches in the Unalakleet River. Recent commercial harvest has been low due to poor weather. Very few fishermen are still fishing, but a strong market is still available for the harvestable surplus. The Department staff does have some concern for the survival of the salmon spawned this season, but the harvest during the final week of the season is unlikely to significantly affect the number of offspring from the 1994 brood year.
3-Z-S-23-94	October 10, 1994 6:00 p.m. ADT	This emergency order opens the Cripple, Penny, Snake, and Nome Rivers to subsistence gillnet fishing as well as through the ice hook and line fishing for all species. This emergency order allows beach seining in the Nome River from Osborne downstream, beach seines remain legal gear in portions of the streams east of Cape Nome and the Sinuk River. All chum salmon caught in beach seines must be released.	The silver salmon escapement in the Nome River is well behind the escapement observed last year. The escapements of the Snake and Cripple Rivers are also thought to be somewhat below average. However, all salmon runs are essentially complete, there are no significant measures to increase the past season's salmon escapements yet to be taken. This emergency order is intended to clarify the regulations and insure that the winter fisheries of the Nome Subdistrict can be fished in a normal manner.
3-S-04-94	August 9, 1994 6:00 p.m. ADT	This emergency order closes the Nome, Snake, Penny and Cripple rivers to sport fishing for coho salmon. Effective 6:00 pm, Tuesday, August 9, 1994 until September 30, 1994, all silver salmon caught in the Nome, Snake, Penny and Cripple rivers must be immediately released.	Although silver salmon runs in eastern Norton Sound have been strong, escapement into the Nome River has lagged behind that observed in 1993. Only about 360 coho had passed the counting tower through Sunday, August 7. This compares about 1,600 by this date last year. A small number (less than 100) silver salmon were seen on a recent survey of the Snake River. Subsistence fishing restrictions are in effect on the Nome, Snake, Penny and Cripple Rivers. The Nome, Snake, Cripple and Penny Rivers are therefore closed to the taking of silver salmon. These restrictions will be lifted if the strength of the coho run will allow for adequate escapement and additional harvest.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-X-S-1-94	July 11, 1994 6:00 p.m. ADT	This emergency order places the Kotzebue District on the normal commercial salmon fishing schedule of two 24 hour periods per week beginning at 6:00 p.m. Monday, July 11 until further notice. The commercial fishing periods will run from 6:00 p.m. Monday until 6:00 p.m. Tuesday and from 6:00 p.m. Thursday until 6:00 p.m. Friday.	In keeping with the management plan published prior to the season, the commercial fishery will open the evening of July 11. The most reliable index of chum salmon run strength is the commercial catch rate. Comparisons of catch rate trends over not less than three periods to the recent 15 year average will be the basis of management decisions for periods 1-8 and Noatak River sonar for periods 9-15. Typically the fishing periods during July are held to 24 hours in length. Unless catch rates deviate significantly from the average, the normal July fishing schedule will continue until August 1.
3-X-S-2-94	July 28, 1994 6:00 p.m. ADT	This emergency order places the Kotzebue District on a commercial salmon fishing schedule of two 36 hour periods per week beginning at 6:00 a.m. Thursday, July 28 until further notice. The commercial fishing periods will run from 6:00 a.m. Monday until 6:00 p.m. Tuesday and from 6:00 a.m. Thursday until 6:00 p.m. Friday.	Commercial catch, catch rates and age composition have indicated an average chum salmon return. Catch rates are higher than average because of the near record low number of participating fishermen. A drop in the Period 5 catch was due to fishermen pulling early because of a lack of market. The department feels this catch would have been near average if markets had not been limited. Age composition indicates an above average 4-year-old return and a lower than average 5-year-old return. The recent 15 year average fishing time for Period 6 is 30 hours and for period 7 is 36 hours. With an average return and roughly half of the permit holders participating, additional fishing time is warranted.
3-X-S-3-94	August 1, 1994 6:00 a.m. ADT	This emergency order places the Kotzebue District on a commercial salmon fishing schedule of daily 6 hour periods as determined by buyer capacity beginning at 6:00 a.m. Monday, August 1 until further notice. The commercial fishing periods will run from 6:00 a.m. until 12:00 noon.	Commercial catch, catch rates and age composition have indicated an average chum salmon return. Catch rates are higher than average because of the near record low number of participating fishermen. However, chum salmon markets are limited and the department is now managing the fishery as not to exceed the markets demand. After the sixth commercial opening when more fish were harvested than processors could handle, the Department's Area Managers met with participating buyers the following day. The outcome of the meeting was that the department would need to know in advance of a commercial opening what the buying capacity would be. Fishing period lengths and frequency would be limited to that capacity. To date, department projects indicate escapement and subsistence needs are being met and are not yet a determining management factor. Currently there are two shore based buyers operating and delivering to a single processor. That processor will accept a limited poundage. Communications with that processor have resulted in period lengths of not more than 6 hours in length. The starting and ending time of the period is determined by that processor so that transportation and processing of the salmon will produce a high quality product. Future fishing periods will be dependent on buyers needs.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-X-S-4-94	August 2, 1994 6:00 p.m. ADT	This emergency order places the Kotzebue District on a commercial salmon fishing schedule of daily 6 hour periods as determined by buyer capacity beginning at 6:00 p.m. Tuesday, August 2 until further notice. The commercial fishing periods will run from 6:00 p.m. until 12:00 midnight.	Same justification as 3-X-S-3-94.
3-X-S-5-94	6:00 p.m. ADT August 4, 1994	This emergency order opens the Kotzebue District to a 3 hour period as determined by buyer capacity beginning at 6:00 p.m. Thursday, August 4. The commercial fishing period will run from 6:00 p.m. until 9:00 p.m.	Commercial catch, catch rates and age composition have indicated an average chum salmon return. Catch rates are higher than average because of the near record low number of participating fishermen. However, chum salmon markets are limited and the department is now managing the fishery as not to exceed the markets demand. After the sixth commercial opening when more fish were harvested than processors could handle, the Department's Area Managers met with participating buyers the following day. The outcome of the meeting was that the department would need to know in advance of a commercial opening what the buying capacity would be. Fishing period lengths and frequency would be limited to that capacity. To date, department projects indicate escapement and subsistence needs are being met and are not yet a determining management factor. Currently there are three shore based buyers operating and delivering to two processors. Those processors will accept a limited poundage. Depending processing capacity, either one or both processors may accept fish on a given day. Communications with those processors have resulted in period lengths not to exceed their capacity. Both processors have agreed to notify the department by no later than 11:00 a.m. each day for consideration of an opening that evening. The starting and ending time of the period is determined by the processors and the department so that transportation and processing of the salmon will produce a high quality product. Future fishing periods will be dependent on buyers capacity.
3-X-S-6-94	August 5, 1994 6:00 p.m. ADT	This emergency order opens the Kotzebue District to a 4 hour period as determined by buyer capacity beginning at 6:00 p.m. Friday, August 5. The commercial fishing period will run from 6:00 p.m. until 10:00 p.m.	Same Justification as 3-X-S-5-94.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-X-S-7-94	August 9, 1994 6:00 p.m. ADT	This emergency order opens the Kotzebue District to a 3 hour period as determined by buyer capacity beginning at 6:00 p.m. Tuesday, August 9. The commercial fishing period will run from 6:00 p.m. until 9:00 p.m.	Commercial catch rates and age composition have indicated an average chum salmon return. Catch rates are higher than average because of the near record low number of participating fishermen. However, chum salmon markets are limited and the department is now managing the fishery as not to exceed the markets demand. After the sixth commercial opening when more fish were harvested than processors could handle, the Department's Area Managers met with participating buyers the following day. The outcome of the meeting was that the department would need to know in advance of a commercial opening what the buying capacity would be. Fishing period lengths and frequency would be limited to that capacity. To date, department projects indicate escapement and subsistence needs are being met and are not yet a determining management factor. Currently there are two shore based buyers operating and delivering to two processors. Those processors will accept a limited poundage. Depending processing capacity, either one or both processors may accept fish on a given day. Communications with those processors have resulted in period lengths not to exceed their capacity. Both processors have agreed to notify the department by no later than 11:00 a.m. each day for consideration of an opening that evening. The starting and ending time of the period is determined by the processors and the department so that transportation and processing of the salmon will produce a high quality product. Future fishing periods will be dependent on buyers capacity.
3-X-S-8-94	August 10, 1994 5:00 p.m. ADT	This emergency order opens the Kotzebue District to a 5 hour period as determined by buyer capacity beginning at 5:00 p.m. Wednesday, August 10. The commercial fishing period will run from 5:00 p.m. until 10:00 p.m.	Same justification as 3-X-S-7-94.
3-X-S-9-94	August 12, 1994 6:00 p.m. ADT	This emergency order opens the Kotzebue District to a 3 hour period as determined by buyer capacity beginning at 6:00 p.m. Friday, August 12. The commercial fishing period will run from 6:00 p.m. until 9:00 p.m.	Same justification as 3-X-S-7-94.
3-X-S-10-94	August 15, 1994 5:00 p.m. ADT	This emergency order opens the Kotzebue District to a 4 hour period as determined by buyer capacity beginning at 5:00 p.m. Monday, August 15. The commercial fishing period will run from 5:00 p.m. until 9:00 p.m.	Same justification as 3-X-S-7-94.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-X-S-11-94	August 16, 1994 5:00 p.m. ADT	This emergency order opens the Kotzebue District to a 4 hour period as determined by buyer capacity beginning at 5:00 p.m. Tuesday, August 16. The commercial fishing period will run from 5:00 p.m. until 9:00 p.m.	Same justification as 3-X-S-7-94.
3-X-S-12-94	August 17, 1994 6:00 p.m. ADT	This emergency order opens the Kotzebue District to a 3 hour period as determined by buyer capacity beginning at 6:00 p.m. Wednesday, August 17. The commercial fishing period will run from 6:00 p.m. until 9:00 p.m.	Same justification as 3-S-X-7-94.
3-X-S-13-94	August 18, 1994 5:00 p.m. ADT	This emergency order opens the Kotzebue District to a 4 hour period as determined by buyer capacity beginning at 5:00 p.m. Thursday, August 18. The commercial fishing period will run from 5:00 p.m. until 9:00 p.m.	Same justification as 3-X-S-7-94.
3-X-S-14-94	August 19, 1994 4:00 p.m. ADT	This emergency order opens the Kotzebue District to a 5 hour period as determined by buyer capacity beginning at 4:00 p.m. Friday, August 19. The commercial fishing period will run from 4:00 p.m. until 9:00 p.m.	<p>Commercial catch, catch rates and age composition have indicated an average chum salmon return. Catch rates are higher than average because of the near record low number of participating fishermen. However, chum salmon markets are limited and the department is now managing the fishery as not to exceed the markets demand. After the sixth commercial opening when more fish were harvested than processors could handle, the Department's Area Managers met with participating buyers the following day. The outcome of the meeting was that the department would need to know in advance of a commercial opening what the buying capacity would be. Fishing period lengths and frequency would be limited to that capacity. To date, department projects indicate escapement and subsistence needs are being met and are not yet a determining management factor.</p> <p>Currently there is only one shore based buyer operating and delivering to a single processor. That processor will accept a limited poundage. The buyer will determine period length as to not exceed their capacity. The processor has agreed to notify the department so that a minimum of 3 hours notice can be posted. Other buyers may purchase fish when they notify the department of their intent. The department is now polling other buyers as to their intent in purchasing fish for the duration of the season. Future fishing periods will be dependent on buyers capacity.</p>

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Emergency Order Number	Effective Date	Action Taken	Comments
3-X-S-15-94	August 22, 1994 9:00 a.m. ADT	This emergency order opens the Kotzebue District to a 9 hour period as determined by buyer capacity beginning at 9:00 a.m. Monday, August 22. The commercial fishing period will run from 9:00 a.m. until 6:00 p.m.	Same justification as 3-X-S-14-94.
3-X-S-16-94	August 23, 1994 9:00 a.m. ADT	This emergency order opens the Kotzebue District to a 9 hour period as determined by buyer capacity beginning at 9:00 a.m. Tuesday, August 23. The commercial fishing period will run from 9:00 a.m. until 6:00 p.m.	Same justification as 3-X-S-14-94.
3-X-S-17-94	August 24, 1994 6:00 a.m. ADT	This emergency order opens the Kotzebue District to a fishing schedule of three 12 hour periods as determined by buyer capacity beginning at 6:00 a.m. Wednesday, August 24. The commercial fishing periods will run from 6:00 a.m. until 6:00 p.m. Wednesday August 24, 6:00 a.m. until 6:00 p.m. Thursday August 25 and 6:00 a.m. until 6:00 p.m. Friday August 26.	<p>Commercial catch, catch rates and age composition have indicated an average chum salmon return. Catch rates are higher than average because of the near record low number of participating fishermen. However, chum salmon markets are limited and the department is now managing the fishery as not to exceed the markets demand. After the sixth commercial opening when more fish were harvested than processors could handle, the Department's Area Managers met with participating buyers the following day. The outcome of the meeting was that the department would need to know in advance of a commercial opening what the buying capacity would be. Fishing period lengths and frequency would be limited to that capacity. To date, department projects indicate escapement and subsistence needs are being met and are not yet a determining management factor.</p> <p>Recent commercial catches have been low because of very few fishermen continuing to fish. Because of these lower catches and few active fishermen, the sole buyer has asked for extended fishing time. He has also requested three days of fishing at this level. The buyer also said that after the third day, Friday, August 26, he would no longer purchase fish.</p>
3-X-S-18-94	August 24, 1994 9:00 a.m. ADT	This emergency order closes commercial periods scheduled for the Kotzebue District. The commercial fishing periods scheduled from 6:00 a.m. until 6:00 p.m. Thursday August 25 and 6:00 a.m. until 6:00 p.m. Friday August 26 are cancelled.	With fewer fishermen and reduced catches during commercial periods on Monday August 22 and Tuesday August 23, the remaining buyer, after announcing he would purchase fish through Friday, has decided not to purchase fish Thursday or Friday. Unless another buyer is interested in purchasing fish for the duration of the season, there will be no more commercial openings in the Kotzebue District. The season closure was activated so that fishermen would not be confused by the previous announcement.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-H-1-94	June 5, 1994 8:00 a.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 5 to commercial fishing, beginning 8:00 a.m. and running until 1:00 p.m. Sunday, June 5. Each boat will be limited to not more than 50 fathoms of gill net.	Aerial survey estimates for this subdistrict have increased for the past 3 days to the current biomass of 3,200 st. Spawn has yet to occur, but is likely soon judging from the roe percentages observed in today's sampling. Roe samples from test sets were mixed, with some sets having roe percentages greater than 9%. Nearly all the immature roe was judged to be nearly ripe or roughly one day from being ripe. The biomass in Subdistrict 5 has built rapidly and is now beginning to move westward out of the subdistrict. This biomass will be unavailable for harvest within a few days if this trend continues. The herring are soon to be at their peak value, a further delay in harvest will result in a lost opportunity to the commercial fishermen of Norton Sound. Today's aerial survey brings the estimated total biomass in Norton Sound to 7,000 short tons. Therefore, a five hour opening will be allowed with the possibility of an extension if quality and quantity can be maintained. Buyers are asked to report by 11:00 a.m. to express their evaluation of the harvest.
3-Z-H-2-94	June 6, 1994 6:00 a.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 1, 2, 3, and 5 to commercial fishing, beginning 6:00 a.m. and running until 9:00 a.m. Monday, June 6. All vessels will be limited to 50 fathoms of gill net during this opening.	Aerial survey biomass estimates indicate a significant increase in the Norton Sound biomass over the past 24 hours from 8,900 st to over 13,000 st. Test fishing by commercial gear indicate very few immature or spawned out fish are susceptible to harvest at this time by the typical commercial gill net. Some locations are still having sex ratios with high male proportions, but the timing of this opening to start after the flood tide begins is an attempt to minimize the catch of males near spawning areas. We now believe the bulk of the older age classes have ripened and are present in near shore waters at their peak quality. The timing of this opening is intended to target these older fish at the highest roe quality, thereby maximizing the value of the harvest. Buyers are asked to report to the Unalakleet Fish and Game office regarding the quality of the harvest by 8:00 a.m. If roe quality is good, there is a possibility of an extension until 11:00 a.m. The gear limit of 50 fathoms will not change if the fishing period is extended.
3-Z-H-3-94	June 7, 1994 9:00 a.m. ADT	This emergency order extends the Norton Sound herring gill net fishing period that began at 6:00 a.m. in Subdistricts 1, 2, 3 and 5 from 9:00 a.m. until 11:00 a.m. Tuesday, June 7.	Reported catch rates from today's gill net fishery are slower than expected. However, the roe quality is holding up well. Several buyers have expressed their wish to continue today's fishery. Judging from the tide graphs, an extension of two hours could be allowed without a great risk of intercepting spawned-out fish moving on the ebb tide.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-H-4-94	June 7, 1994 12:00 noon ADT	This emergency order opens Subdistricts 2 and 3 of the Norton Sound Commercial Herring Fishing District to the commercial beach seining of herring, beginning 12:00 noon Tuesday, June 7 and running until further notice. The opening will be under the direct supervision of a management biologist, who will have on site authority to open and close periods to prevent gear conflicts, facilitate enforcement, maximize allowable harvest and conduct an orderly fishery. The biologist will limit the extent of the fishery in area and in the number of participants.	The Norton Sound Herring Management Plan states that the beach seine harvest will not exceed 780 st. A beach seine harvest has not occurred to date. Due to the long drawn out season, all beach seine fishermen signed a cooperative agreement where they would consolidate their efforts to harvest the remaining portion of the beach seine quota. The beach seiners also expressed the concern for maximizing the roe quality in the harvest by taking all the time required to evaluate roe quality prior to pumping. The catch would be evenly split between the permits. If roe quality is unacceptable to prospective buyers, the herring will be released before drying-up. Once a set has been accepted, the fish will be pumped by a tender and any excess fish above the set quota will be released. Therefore, the allowable catch could be fully utilized with little threat of overharvest.
3-Z-H-5-94	June 8, 1994 3:00 a.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 1, 2, and 3 to commercial fishing, beginning 3:00 a.m. and running until 10:00 a.m. Wednesday, June 8. All vessels will be limited to 100 fathoms of gill net during this opening.	<p>Aerial survey estimates indicate a significant increase in the Norton Sound biomass over the past 24 hours from roughly 13,000 st to over 22,000 st. The continuing rise in the daily biomass estimates in Subdistricts 1, 2, and 3 makes the continuation of this trend likely and that should cause the harvest rate of this fishing period to increase as well. Today's commercial fishery indicates the fish available in nearshore waters are of very high quality.</p> <p>Biomass in Subdistrict 5 continues to decline and the fact that there was no fishing effort there are the reasons that subdistrict will not open.</p> <p>The gear limit has been increased to 100 fathoms. Fishermen have demonstrated their ability to select high roe quality fish and avoid the poor quality product that was a problem in past years. Earlier concern for roe quality had caused the staff to require close tending of the gear, by limiting the fishermen to one net per boat, to avoid excessive harvest of low roe quality fish. Because the catch rate was so low today and the roe quality was excellent, there is no longer a reason to purposefully slow the harvest rate.</p>

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Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-H-6-94	June 9, 1994 4:00 a.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 1, 2, 3, and 5 to commercial fishing, beginning 4:00 a.m. and running until 11:00 a.m. Thursday, June 9. All vessels will be limited to 100 fathoms of gill net during this opening.	<p>The current herring biomass estimate is over 22,000 st. The current exploitation rate in the fishery is roughly three percent, well below the 20 percent allowed by regulation. Today's commercial fishery indicates the fish available in the nearshore waters of Subdistricts 1, 2, and 3 are of high quality. Reports of active spawn occurring in Subdistrict 5 also indicate the availability of roe quality herring.</p> <p>With the departure of several tenders and at least one processor over the last 24 hours, fishermen are cautioned to be sure they have a market prior to setting their nets.</p> <p>The gear limit has been increased to 100 fathoms. Fishermen have demonstrated their ability to select high roe quality fish and avoid the poor quality product that was a problem in past years. Earlier concern for roe quality had caused the staff to require close tending of the gear, by limiting the fishermen to one net per boat, to avoid excessive harvest of low roe quality fish. Because the catch rate was so low today and the roe quality was excellent, there is no longer a reason to purposefully slow the harvest rate.</p>
3-Z-H-7-94	June 9, 1994 11:00 a.m. ADT	This emergency order extends the Norton Sound herring gill net fishing period that began at 4:00 a.m. in Subdistricts 1, 2, 3 and 5 from 9:00 a.m. until 1:00 p.m. Thursday, June 9.	Reported catch rates from today's gill net fishery are slow. However, the roe quality is holding up well. A buyer has expressed their wish to continue today's fishery. Judging from the tide graphs, an extension of two hours could be allowed without a great risk of intercepting spawned-out fish moving on the ebb tide.
3-Z-H-8-94	June 21, 1994 6:00 p.m. ADT	This emergency order opens a Norton Sound herring gill net fishing period, in Subdistrict 7, beginning at 6:00 p.m. Tuesday, June 21 and continuing until 6:00 p.m. Wednesday, June 22.	A buyer has expressed an interest in buying 30 tons of bait quality herring at Nome. An aerial survey flown yesterday sighted roughly 7,500 tons of herring in Subdistrict 7. Given this year's low harvest of herring but 38,000 ton biomass estimate there is an adequate harvestable surplus for a considerably larger harvest. The buyer has a limited capacity, so fishermen are asked to be aware of the limitations of the market and not to exceed the limits placed on them by the buyer. Participation in this fishery is expected to be low, consequently the 24 hour opening. The size of the herring is unknown, but is expected to be small due to the expectation that most fish will be past spawning. Smaller mesh nets are advised for the fishery than those used in the sac roe fishery.

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Emergency Order Number	Effective Date	Action Taken	Comments
3-Z-K-1-94	May 15, 1994 12:00 noon ADT	This emergency order extends the Norton Sound winter crab season to 12:00 noon May 31.	<p>Although spring is here and sea ice is fast becoming unsafe for travel the Department staff has been requested to extend the winter season to accommodate the commercial fishermen of the Port Clarence area. Sea ice there is expected to remain stable for most of the month of May. Fishermen are advised to use caution while traveling on the sea ice in any location.</p> <p>Roughly 14,000 pounds of crab have been sold this season. The harvest is far short of the allocation of 340,000 pounds for the winter fisheries of Norton Sound. This action is intended to allow a greater window of opportunity to fishermen who have generally had a poor season. The harvest during this extension is not expected to exceed 1,000 pounds. Realistically, there is no chance the winter allocation could be met. This action can not be viewed as a reallocation of the resource between winter and summer user groups.</p>
3-Z-K-2-94	July 1, 1994 12:00 noon ADT	This emergency order relaxes the closure line northward to 64°20' north latitude and eastward to 161°30' west longitude effective 12:00 noon July 1.	<p>Catch rates in the Norton Sound king crab fishery have been quite slow in early July when the fishery was conducted south of the closure line listed in the regulation book. The poor catch rate is thought to be caused by the early timing of the fishery and the seasonal migration of the crab. By allowing fishing nearer the shore, an increased catch rate should result. The subsistence catches as late as early June indicate there are king crab in fishable densities in eastern Norton Sound.</p> <p>Residents of eastern Norton Sound villages have requested that commercial fishing be allowed in areas accessible to their villages. These two considerations are the basis of this order.</p> <p>As the season progresses, catch rates and the proportion of sublegal crab will be monitored. Adjustments to the closure line will be made to minimize the handling of sublegal crab while still providing a reasonable harvest of legal crab. The risk of handling sublegal crab and the associated mortality was considered prior to this decision. Fishermen have the ability to rapidly move off small crab if they find themselves in a poor location, since there will probably be large areas with no fishing effort this year.</p>

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Emergency Order Number	Effective Date	Action Taken	Comments
3-2-K-3-94	July 9, 1994 6:00 a.m. ADT	This emergency order relaxes the existing closure line eastward to 161°15' west longitude effective 6:00 a.m. July 9.	<p>Catch rates in the eastern Norton Sound king crab fishery have been quite slow. There have been reports indicating some crab near the present eastern closure line, one of the few places in eastern Norton Sound where crabbers have found a hard bottom. King crab are not generally found on mud bottoms. By allowing fishing nearer the shore, an increased catch rate may result. The subsistence catches as late as early June indicate there were king crab in fishable densities in eastern Norton Sound.</p> <p>Residents of eastern Norton Sound villages have requested that commercial fishing be allowed in areas accessible to their villages. The low level of effort present in eastern Norton Sound is not expected to have a significant impact on the winter crab fisheries.</p>
3-2-K-4-94	July 31, 1994 6:00 p.m. ADT	This emergency order closes the summer commercial king crab fishery in the Norton Sound Section effective 6:00 p.m. July 31.	A NMFS trawl study estimated 3,400,000 pounds of legal male red king crab to be in open waters during late August 1991. The Norton Sound red king crab stock has been exploited at 10% in recent years while maintaining a modest upward trend in population size. The reported verbal catch is 301,000 pounds of crab. By allowing the commercial fishery to continue three days the harvest is expected to reach the ten percent harvest goal of 340,000 pounds. The three day notice is intended to allow the crabbers adequate time to remove their pots from the water prior to the closure.
P O R T CLARENCE	October 10, 1994 12:00 noon	<p>Kuzitrin and Pilgrim Rivers Whitefish.</p> <p>Commercial fishermen operating on the Kuzitrin and Pilgrim Rivers are hereby notified the whitefish harvest quotas have been met for this season. Commercial whitefish harvest on both of these rivers will be closed from Noon Friday October 14, 1994 until September 15, 1995.</p>	<p>The freshwater finfish are managed on the basis of a winter season. That season runs from September 16 until May 15. Since these stocks are harvested from the locations where they overwinter, the season is arranged to allow only one quota to be taken from an overwintering stock. The summer closure is intended to simplify the enforcement of summer fisheries and direct harvest away from mixed populations of fish.</p> <p>These are the first quotas to be taken this season in either the freshwater or saltwater fisheries. Many quotas have yet to be harvested. Fishermen are encouraged to call the Nome Fish and Game office to learn the status of the other possible winter fisheries. Fishermen must register with the Nome Office prior to selling fish taken in Norton Sound. The Department's toll free number is 1-800-560-2271.</p>

Appendix G4. Norton Sound, Port Clarence, Kotzebue Sound processors and associated data, 1994.

Company	Representative Address	Type of Processing	District
Arctic Fish Co.	Kotzebue	Fresh Salmon	Kotzebue
Glacier Fish Company (Co-op herring with Trident & NSEDC)	1200 West Lake Ave Suite 900 Seattle, WA 98109	Frozen Salmon Frozen Herring	Norton Sound Norton Sound
Icicle Seafoods	4019-21st Ave West Seattle, WA 98199	Frozen Herring	Norton Sound
Inlet Fisheries	P.O. Box 530 Kenai, 99611	Fresh Salmon	Kotzebue
Kotzebue Commercial Fisherman Inc.	P.O. Box 193 Kotzebue, AK 99752	Fresh Salmon	Kotzebue
New West	601 West Chestnut Bellingham, WA 98226	Frozen Herring	Norton Sound
Nome Crab Co.	P.O. Box 1004 Nome, AK 99762	Frozen Crab	Norton Sound
Norton Sound Crab Company	P.O. Box 906 Nome, AK 99762	Frozen Crab Frozen Salmon Misc Bait Fish	Norton Sound Norton Sound Norton Sound
Norton Sound Economic Develop. Corp. (Co-op herring with Glacier & Trident)	P.O. Box 39089 Elim, AK 99739	Frozen Herring	Norton Sound
Norquest	4225 23rd Ave West Seattle, WA 98199	Frozen Herring	Norton Sound
North Alaska Fisheries	Kotzebue	Fresh Salmon	Kotzebue
Pan Pacific Seafood	150 Nickerson St. Suite 103 Seattle, WA 98109	Frozen Herring	Norton Sound

Company	Representative Address	Type of Processing	District
Sahalee of AK	P.O. Box 104174 Anchorage, AK 99510	Frozen Crab	Norton Sound
Trident (co-op herring with Glacier & NSEDC)	5303 Shilshole Ave NW Seattle, WA 98107	Frozen Herring	Norton Sound
Whitney Foods	4401 W Intl Aiport Rd Anchorage, AK 99502	Fresh Salmon	Norton Sound
YAK Inc.	180 Nickerson St. Suite 105 Seattle, WA 98109	Frozen Herring	Norton Sound

LITERATURE CITED

- ADF&G. (Alaska Department of Fish and Game). 1995. Norton Sound- Port Clarence -Kotzebue Sound Annual Management Report, 1993. Division of Commercial Fisheries Management and Development. AYK Regional Information Report No. 3A95-06. Anchorage.
- ADF&G. 1994. Pacific Herring Stocks and Fisheries in the Arctic-Yukon-Kuskokwim Region of the Bering Sea, Alaska, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Information Report No. 3A94-34. Anchorage.
- Bahnke, D.L. 1995. 1994 Roving Herring Test Fish. Memorandum to Fred Bue. April 28, 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Nome.
- Barton, L.H. 1978. Finfish Resource Surveys in Norton Sound and Kotzebue Sound. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Region OCS Report. Alaska Marine Environmental Assessment Project, Research Unit 19. September, 1978. Anchorage.
- Bockstoce, John. 1979. The Archeology of Cape Nome, Alaska. The University Museum, University of Pennsylvania, Philadelphia.
- Brennan, E.L. 1993. Norton Sound Winter Red King Crab Studies 1993. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. AYK Regional Informational Report No. 3A93-13. Anchorage.
- Brennan, E.L. 1994. Norton Sound Summer Commercial Red King Crab Fishery Observer Project Summary Report, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. AYK Regional Informational Report No. 3A94-27. Anchorage.
- Bue, F.J. 1994. 1994 Norton Sound Salmon Season Summary. Memorandum to Rich Cannon from Bue. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Nome. October 24, 1994.
- Bue, F.J. and C.F. Lean. 1994. 1994 Norton Sound District Salmon Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. Regional Information Report No. 3A94-32. Anchorage.
- Knuepfer, G. 1994. Cape Denbigh Herring Test Fish Project. Memorandum to Fred Bue. September 2, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Nome.
- Lean, C.F. 1994. Norton Sound Red King Crab Preliminary Report. Memorandum to John Hilsinger. August 23, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Nome.

LITERATURE CITED (continued)

- Lean, C.F. and E.L. Brennan. 1995. 1994 Norton Sound District Shellfish Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Information Report No. 3A95-25. Anchorage.
- Lingnau, T.L. 1994. Kobuk River Test Fishing Project, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. Regional Information Report No. 3A94-35. Anchorage.
- Lingnau, T.L. 1994. Kotzebue Season Summary, 1994. Memorandum to Rich Cannon. October 10, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Kotzebue.
- Lingnau, T.L. and C.F. Lean. 1994. 1994 Kotzebue District Fisheries Report to the Alaska Board of Fisheries. Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Information Report No. 3A94-33. Anchorage.
- Peterson, J.M. 1994. 1994 Roving Herring Test Fish. Memorandum to Fred Bue. June 20, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Nome.
- Ray, D.J. 1984. Bering Strait Eskimo. *In* Handbook of North American Indians, Volume 5, Arctic, William C. Sturtevant, gen. ed., David Damas, vol. ed. pp. 285-302. Smithsonian Institution, Washington.
- Ray, D.J. 1975. The Eskimos of Bering Strait, 1650-1898. University of Washington Press, Seattle, WA.
- Rob, P.J. 1995. 1994 Nome River Counting Tower Report. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. Regional Information Report No. 3A95-35. Anchorage.
- Rob, P.J. *In Press a.* 1994 Kwiniuk River Counting Tower Report. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. Regional Information Report No. __. Anchorage.
- Rob, P.J. *In Press b.* 1994 Unalakleet Test Fish Project Summary. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. AYK Regional Informational Report No. __. Anchorage.
- Thomas, Dan. 1982. The Role of Local Fish and Wildlife Resources in the Community of Shaktoolik, Alaska. Alaska Department of Fish and Game, Subsistence Division. January 15, 1982.